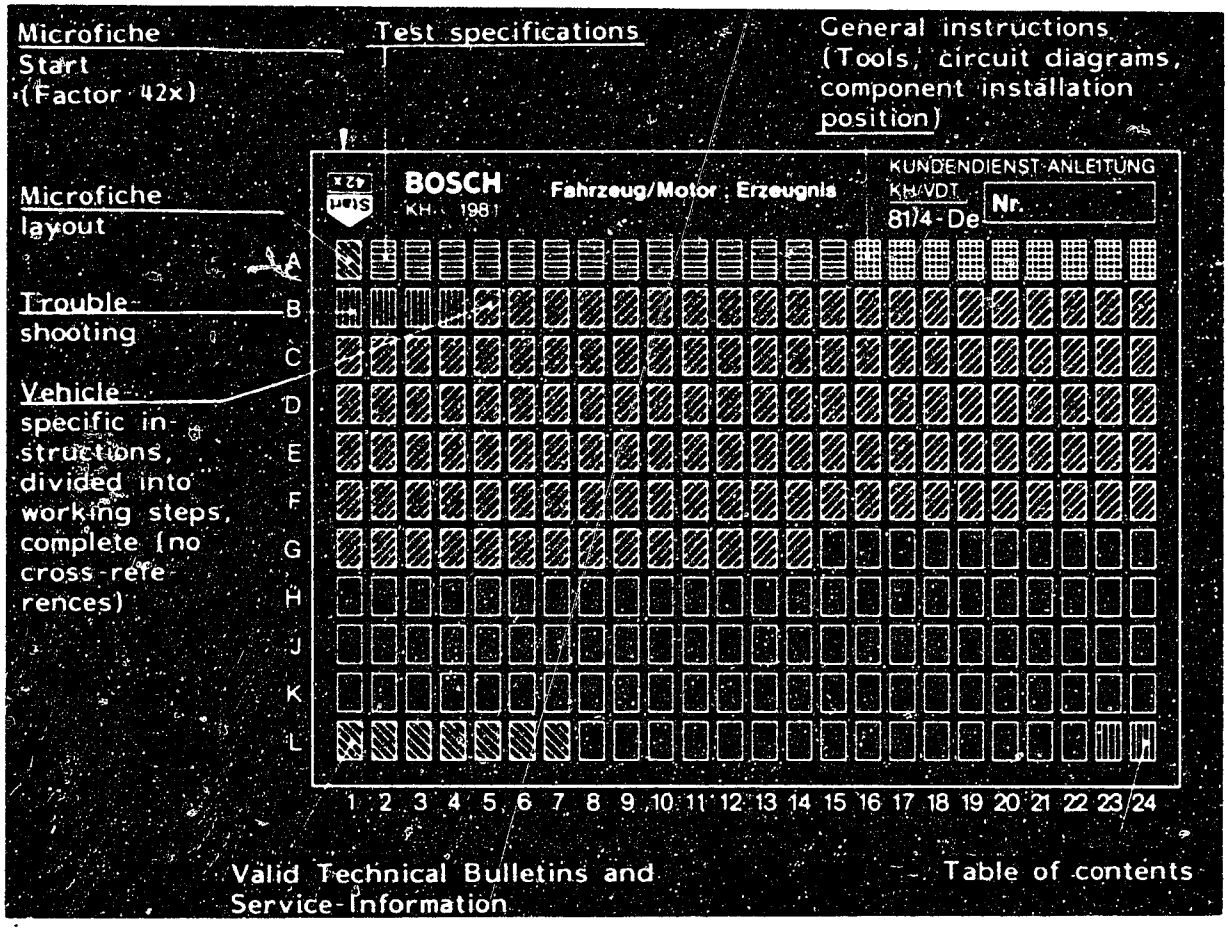
Microfiche layout



1. Read from left to right

2. Title of microfiche (appears on each coordinate)

E 16	Product/assembly/test step Vehicle/engine	

Coordinate

3. Limits of section

Beginning | Mid-section | End | One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

C 6

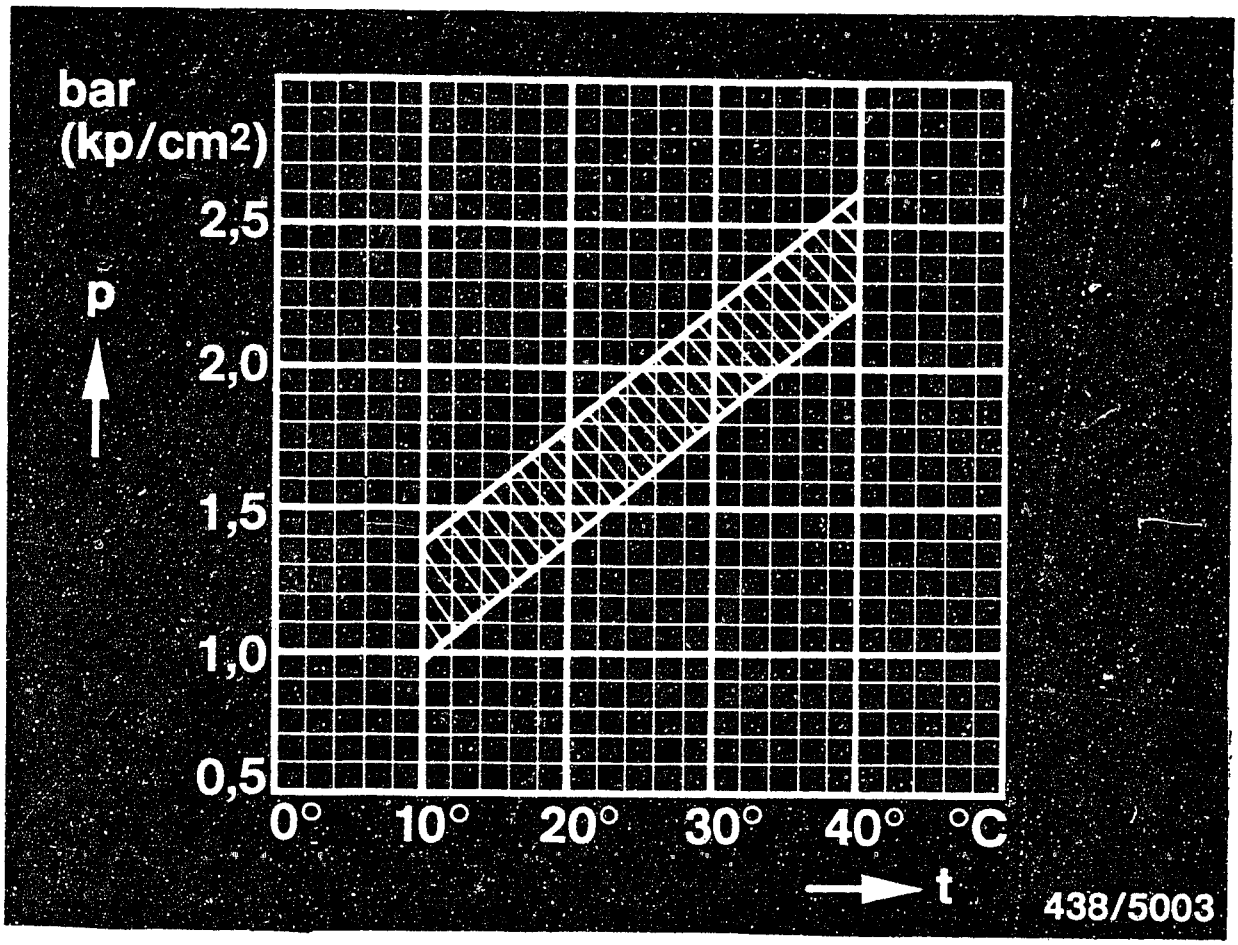
A 1	Trouble-Shooting Plan	↓

1. Test specifications

1.1 Electric fuel pump

C1

Test step	Test specifications
Fuel delivery	min. 750 cm^3/30 s



p = Control pressure (gauge pressure)
t = Ambient temperature

C 18

1.2 Control pressure "cold"

Part No. of warm-up regulator: 0 438 140 004

Test step	Test specifications*
1.3 Control pressure "warm" **C 18**	
Warm-up regulator:	
0 438 140 004	3.4...3.8 bar (3.5...3.9 kgf/cm^2)
1.4 Primary pressure **D 11**	
Fuel distributor	
0 438 100 023	
0 438 100 074	
Checking value:	4.5...5.2 bar (4.6...5.3 kgf/cm^2)
Setting value:	4.7...4.9 bar (4.8...5.0 kgf/cm^2)
1.5 Leak test **D 19**	
Minimum pressure	
after 10 minutes:	1.9 bar (2.0 kgf/cm^2)
after 20 minutes:	1.7 bar (1.8 kgf/cm^2)
1.6 Injection valves **E 18**	
Opening pressure:	
Injection valve:	
0 437 502 007	2.5...3.6 bar (2.6...3.7 kgf/cm^2)
0 437 502 015	
up to FD 828:	2.7...3.8 bar (2.8...3.9 kgf/cm^2)
from FD 829:	3.0...4.1 bar (3.1...4.2 kgf/cm^2)

*Pressures in the test-specification table are given in bar (gauge pressure) and/or in kgf/cm^2 (gauge pressure)

1.7 Fuel distributor

F6

Delivered-quantity comparison.

Fuel distributor - Part No.:
0 438 100 023
074

	Setting point cm^3/min	Max. allowable delivery cm^3/min
Idle	6.0	6.8
Part load	40.0	44.0
Full load	160.0	175.0

1.8 Idle adjustment*

F19

Idle speed:	
All models:	900 min^{-1}
CO concentration (% by vol.):**	
Checking value:	
B 19 E, B 21 E, 1978...1980	1.0...3.0 %
B 23 E 1978...1980	1.5...2.5 %
All models 1981	0.5...2.0 %
Setting value:	
All models 1978...1980	2.0 %
All models 1981	1.0 %

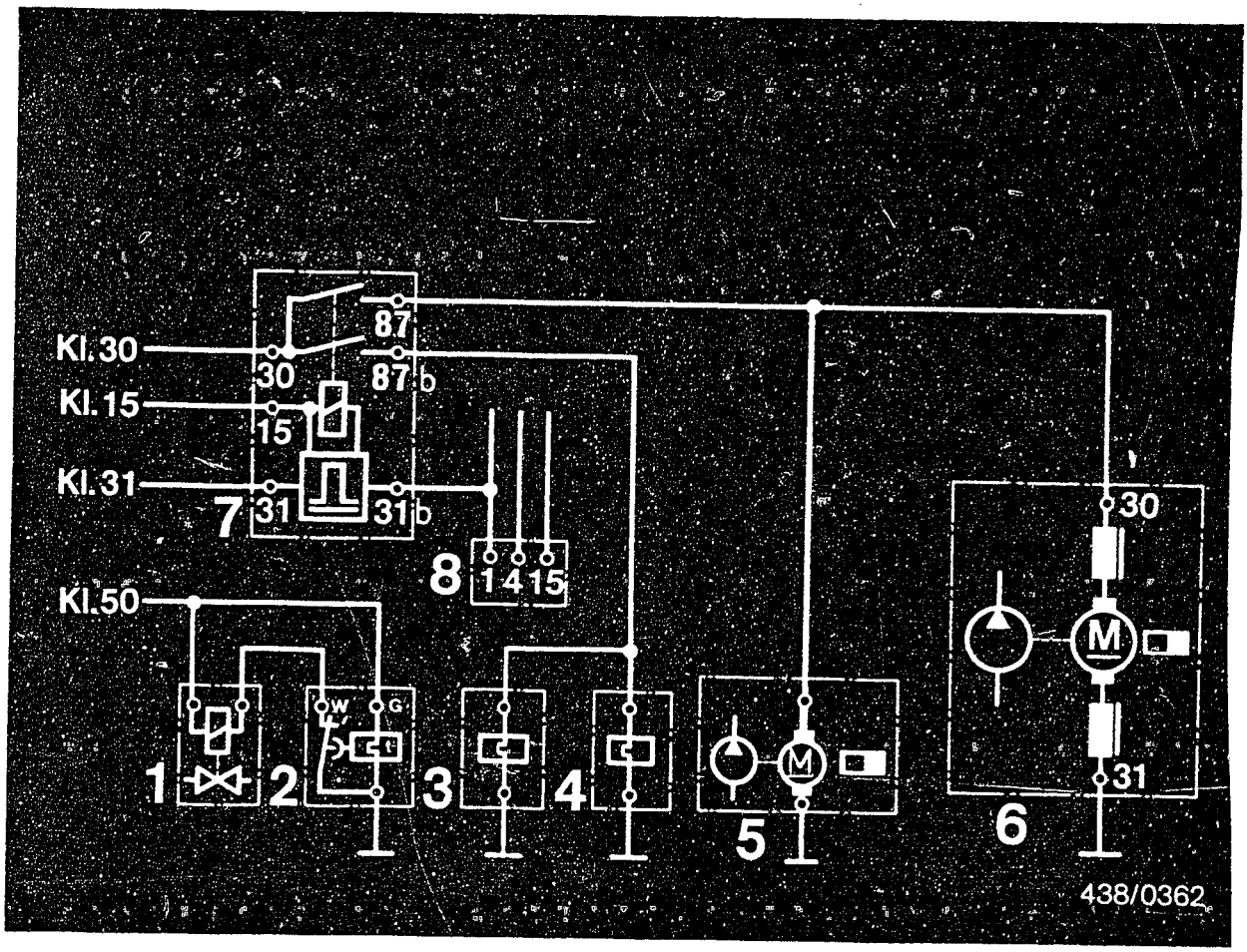
* Vehicles with B 23 E engine of the Sweden and Australia version are equipped with exhaust-gas recirculation (for afterburning of the exhaust gas) and "Puls-air" system (secondary-air injection in the exhaust system).
For checking and adjusting the idle speed. both systems must be rendered inoperative as follows:

Exhaust-gas recirculation: Remove the vacuum hose from the exhaust-gas recirculation valve and seal off tight with a plug.

Puls-air system: Remove the hose line from the air filter to the double valve fitting at the air filter and seal off tight with a plug.

**Re-adjust CO according to "setting value".

Engines whose CO concentration is within the "checking value" tolerance need not be re-adjusted if otherwise idling smoothly.

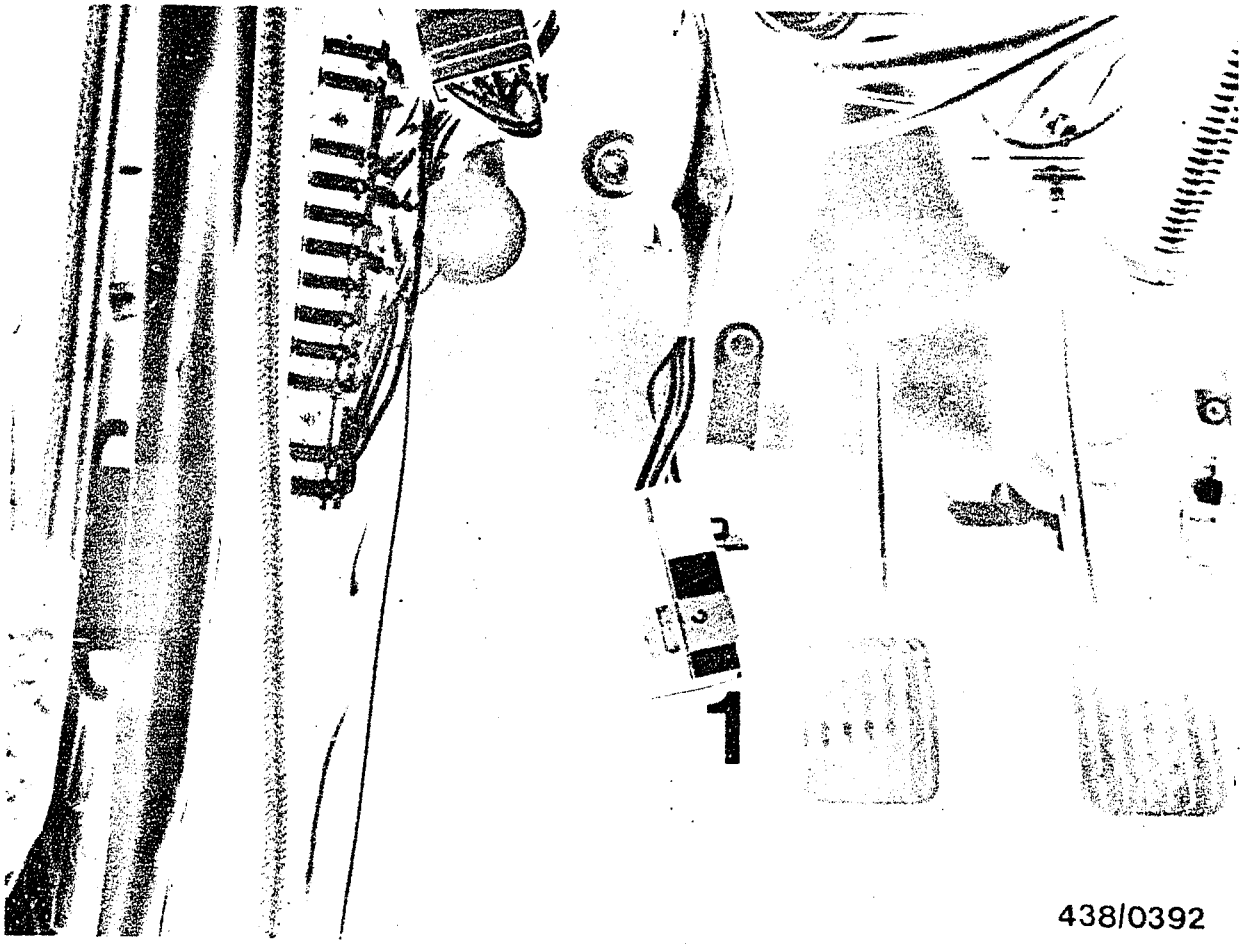


2. Electrical safety circuit

The safety circuit employs an electronic relay which is triggered from terminal 1 of the ignition coil.

2.1 Circuit diagram

1 = Start valve
2 = Thermo-time switch
3 = Warm-up regulator
4 = Auxiliary-air device
5 = Pre-supply pump
6 = Electric fuel pump
7 = Electronic relay
8 = Ignition coil



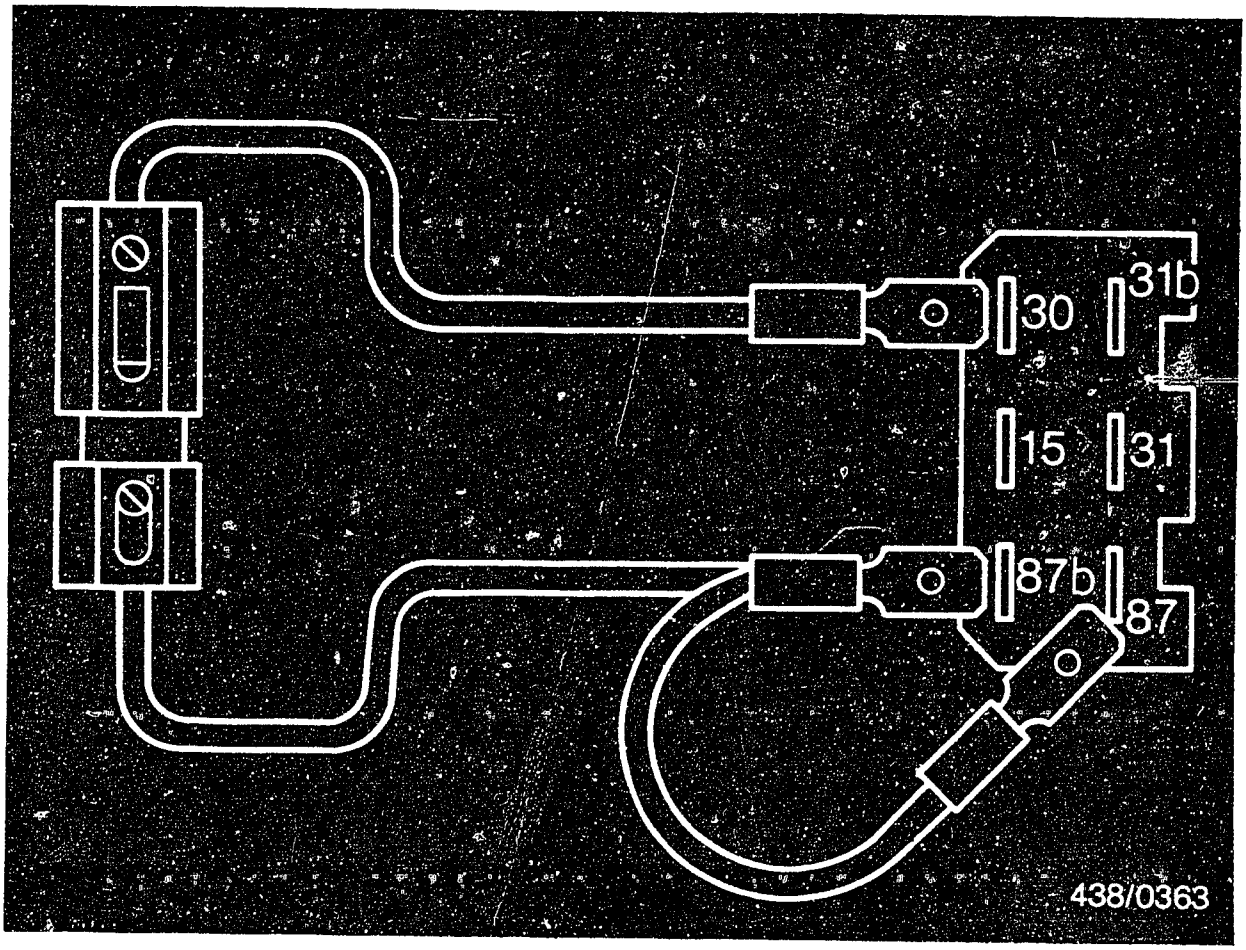
438/0392

2.2 Bridging the safety circuit

In order to carry out testing with the engine stationary, it is necessary to bridge the safety circuit.

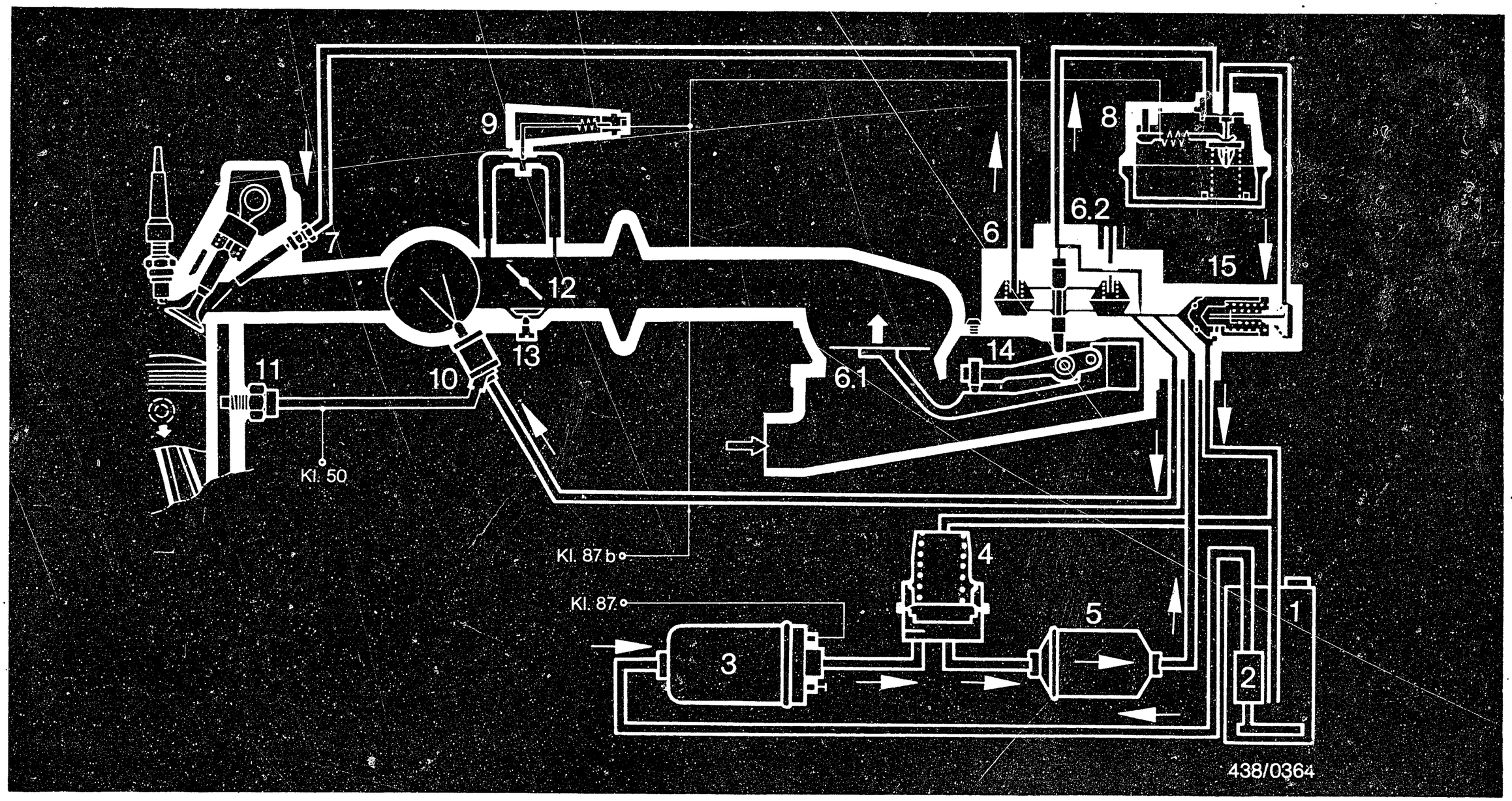
The relay (1) is fastened on a mounting piece left of the steering column under the instrument panel (picture shows relay removed from its mounting). Remove the relay in order to bridge the safety circuit.

The relay is made accessible by removing the left-hand underside trim of the instrument panel and the left-hand side trim in the footwell.



Connect contacts 87 and 87b with contact 30 in the base with a twin bridge.
Use connecting cable 1.5 mm² with fuse holder and 16 A fuse.

Electric fuel pump, pre-supply pump, warm-up regulator and auxiliary-air device are now supplied with battery voltage.



3. Diagram of fuel lines

1 = Fuel tank
2 = Pre-supply pump
3 = Electric fuel pump
4 = Fuel accumulator
5 = Fuel filter
6 = Mixture-control unit
6.1 = Air-flow sensor
6.2 = Fuel distributor
7 = Injection valve
8 = Warm-up regulator
9 = Auxiliary-air device
10 = Start valve
11 = Thermo-time switch
12 = Throttle valve
13 = Idle-speed-adjusting screw (bypass)
14 = Idle-mixture screw
15 = Primary-pressure regulator with push valve

4. General information

4.1 Introduction

This repair manual refers to the Volvo models 240... with engines B 19 E, B 21 E, B 23 E as from 1978 model. It has been possible to combine these three different models because they are equipped with the same engine type and are thus identical with regard to K-Jetronic components.

The manual gives a concise description of the testing and adjustment operations to be performed on the vehicle on the K-Jetronic.

All the system components are dealt with in separate working steps with the corresponding test specifications.

In addition to this repair manual the appropriate testing and repair manuals will, of course, be issued for every other vehicle type equipped with the K-Jetronic.

The K-Jetronic differs from other known fuel-injection systems in terms of both construction and operation. In order to be able to carry out the testing procedures described in this manual - and therefore to be able to assess the components - the K-Jetronic and its operation should be clearly understood. The essential points of the operation and construction of the K-Jetronic are described in Technical Instruction VDT-U 3/1 En.

When trouble-shooting the K-Jetronic, it is assumed that the ignition is in order and that the engine is in proper mechanical condition.

The individual test steps of this repair manual are detailed and self-contained. This permits direct trouble-shooting without having to go through the entire test program for each fault.

The trouble-shooting chart on Coordinates B 1 - B 4 is intended to make it easier to decide which test steps have to be carried out for certain faults.

According to the symptom stated by the customer or which you yourself have determined, select the possible cause in the trouble-shooting chart. The coordinate at the end of the cause column refers to the appropriate test step with the associated test specification.

Important note:

If any fuel connections are loosened, parts removed, also on the vacuum system, always use new seals when re-connecting or re-installing.

Ensure utmost cleanliness when working on the K-Jetronic. Clean the outside of fuel connections thoroughly before loosening.

4.2 Design of the K-Jetronic:

The entire system of the K-Jetronic in the Volvo 240 ... with the above-mentioned engine versions corresponds to the basic design as described in Technical Instruction VDT-U 3/1.

An additional component is the fuel pre-supply pump (not made by Bosch) which is installed in the fuel tank. When testing the electric fuel pump (testing the fuel delivery), bear in mind the possible influence of the pre-supply pump.

4.4 Electrical safety circuit:

As in the other Volvo models, the electrical safety circuit employs an electronic rotational-speed relay.

4.5 Other equipment:

The B 23 E engine in vehicles of the Sweden and Australia version is equipped with exhaust-gas recirculation (EGR) and with the "Puls-air" secondary-air system.

With exhaust-gas recirculation, some of the exhaust gas is returned from the exhaust system to the intake system in order to take part once again in combustion. This reduces the proportion of nitrogen oxides (NO_x) in the exhaust gas. Exhaust-gas recirculation is inoperative when the engine is cold and when the engine is idling.

With the Puls-air system unburned gases in the exhaust are afterburned by the injection of air, likewise resulting in a reduction of pollutants in the exhaust gas.

The system does not employ a secondary-air pump, but uses the pulsation in the alternation between overpressure and depression in the exhaust system. When there is a depression, auxiliary air is drawn into the exhaust manifold. When there is overpressure, non-return valves prevent the exhaust gas from flowing back to the air filter.

5. Test equipment and tools

- Pressure tester KDJE-P 100 (previously KDEP 1034)

For testing all fuel pressures and testing for leaks.

- Connecting-parts set KDJE-P 100/10 (previously KDEP 1034/10)

For connecting pressure tester KDJE-P 100 (previously 1034/10) to the control-pressure port of the fuel distributor.

- Adjusting wrench KDEP 1035

For adjusting the idle-mixture-adjusting screw in the mixture-control unit (CO-adjustment).

- Guide ring KDEP 1040/10 (dia. 80 mm)

For centering the air-flow sensor plate in the air-flow sensor.

- Tester for delivered quantity comparison KDJE-P 200 (previously KDJE 7451)

For comparing the fuel delivered from the individual fuel-distributor outlets.

- Electric connecting cable (test lead)

KDJE 7450/70 for the direct connection of components to be tested, e.g. cold-start valve.

- Graduate (commercially available, capacity approx. 1.5 l)

For measuring the delivery of the electric fuel pump.

- Valve tester KDJE-P 400 (previously KDJE 7452).

For testing the injection valves.

Test media: Calibrating fluid (Shell K 30, Esso-Varsol, Shell Mineral Spirits 135)
or
Bosch, Part Designation 14 942-CH
Previousl, Part No. 5 973 340 650
The Bosch calibrating fluid can be obtained in 5 l metal cans from the following supplier:

Firma
Oskar Gnamm GmbH & Co.
D-7531 Kämpfelbach-Bilfingen

Caution:
For safety reasons, never use normal gasoline or similar easily inflammable and combustible liquids.
Even with calibrating fluid, be sure to observe the local official regulations.

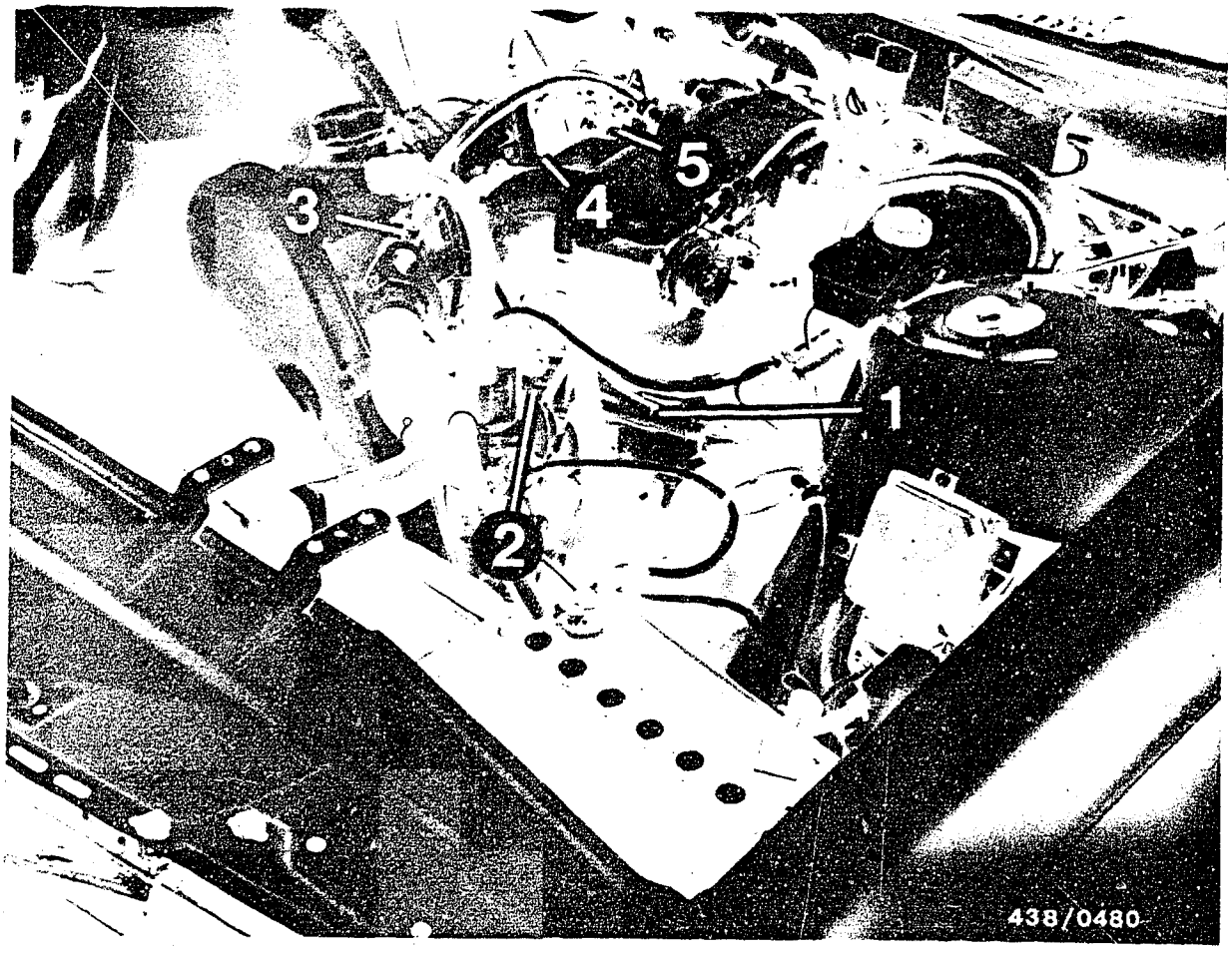
- Tachometer (commercially available)

For idle-speed adjustment

- CO meter (commercially available)

For idle-speed CO adjustment.

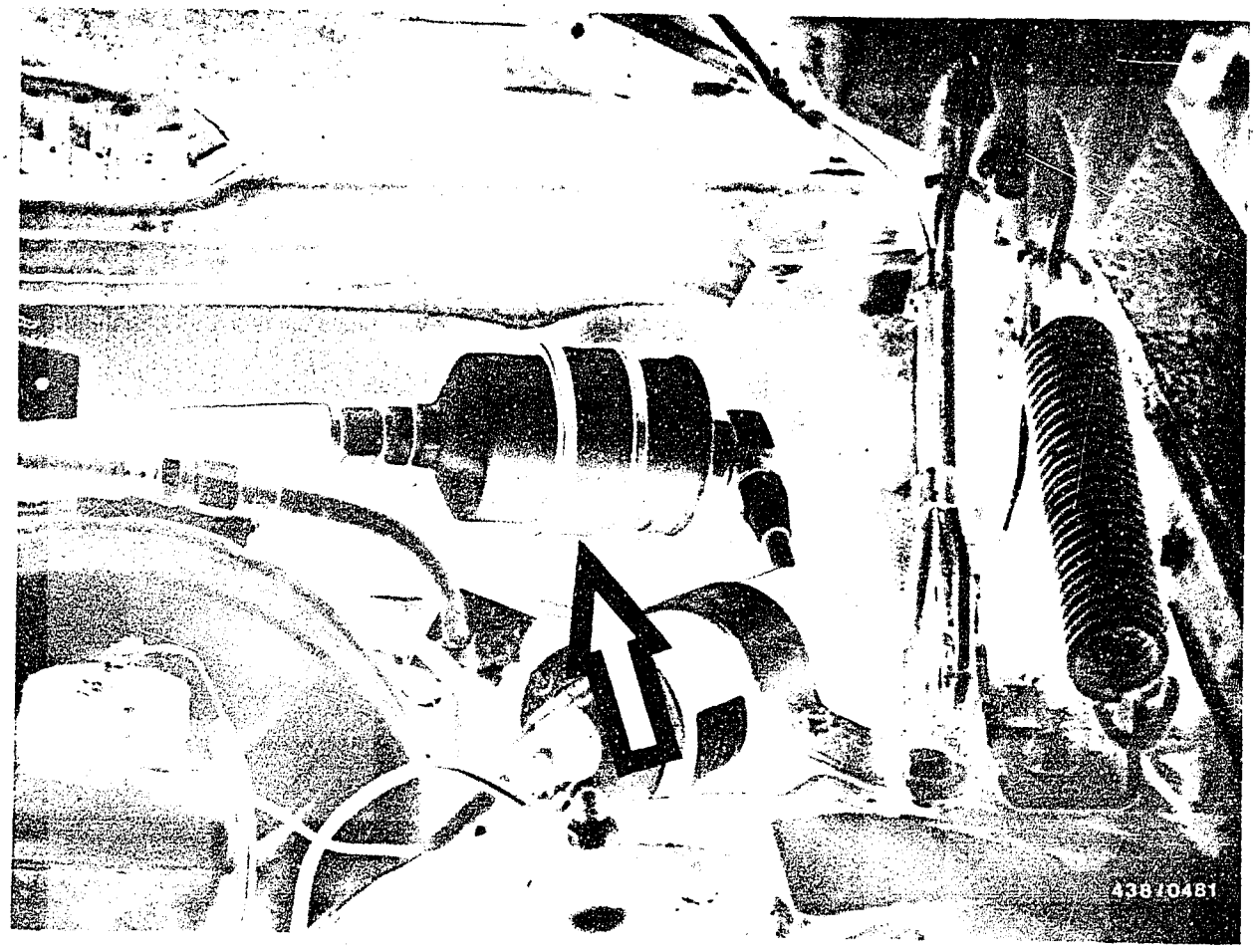
- Set of tools for the removal and fitting of idle-CO-anti-tamper device of air-flow sensor.
 (e.g. No. 4521/7 from the firm Hazet, D-5630 Remscheid).



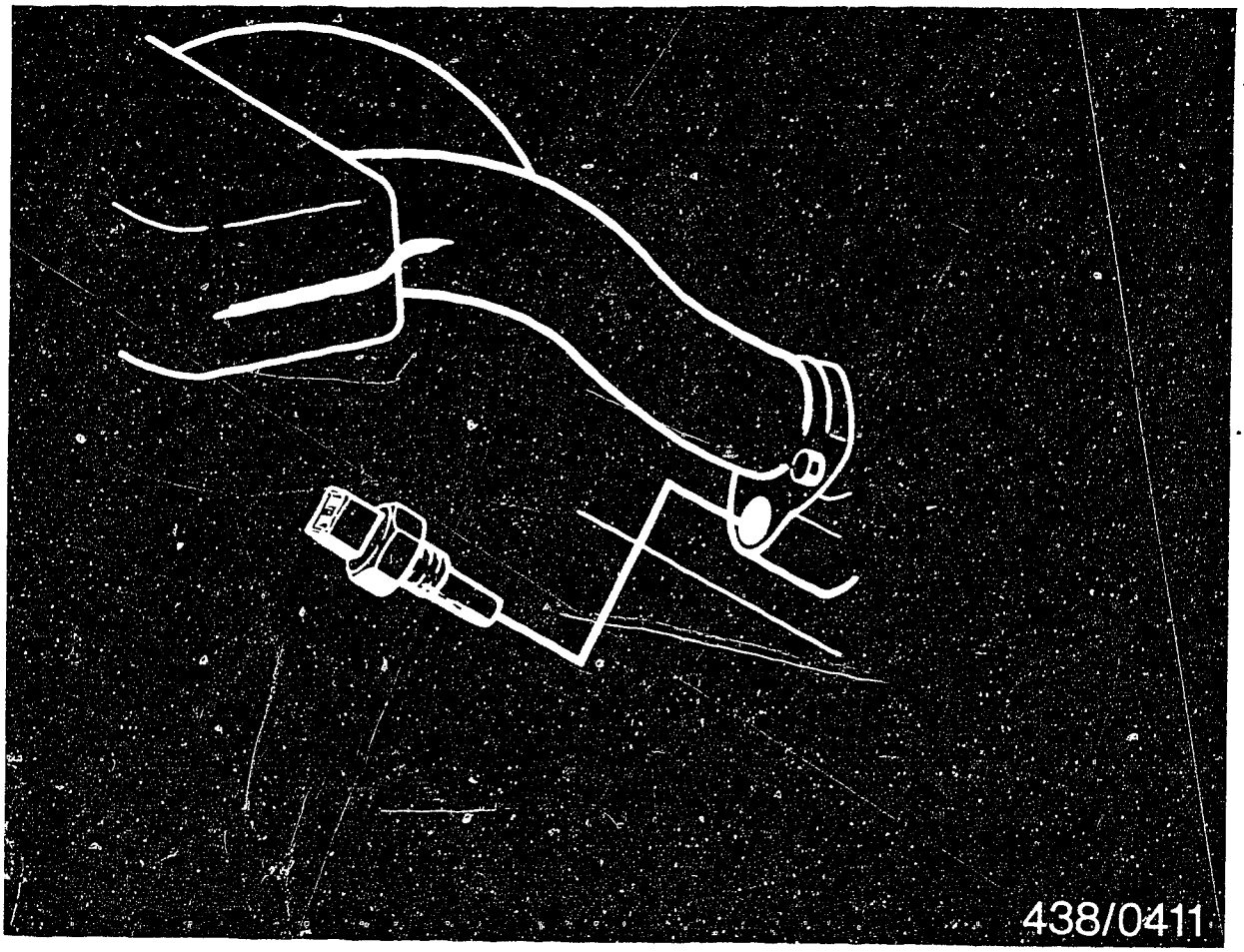
6. Installation position of individual components

Arrangement of components on the engine:

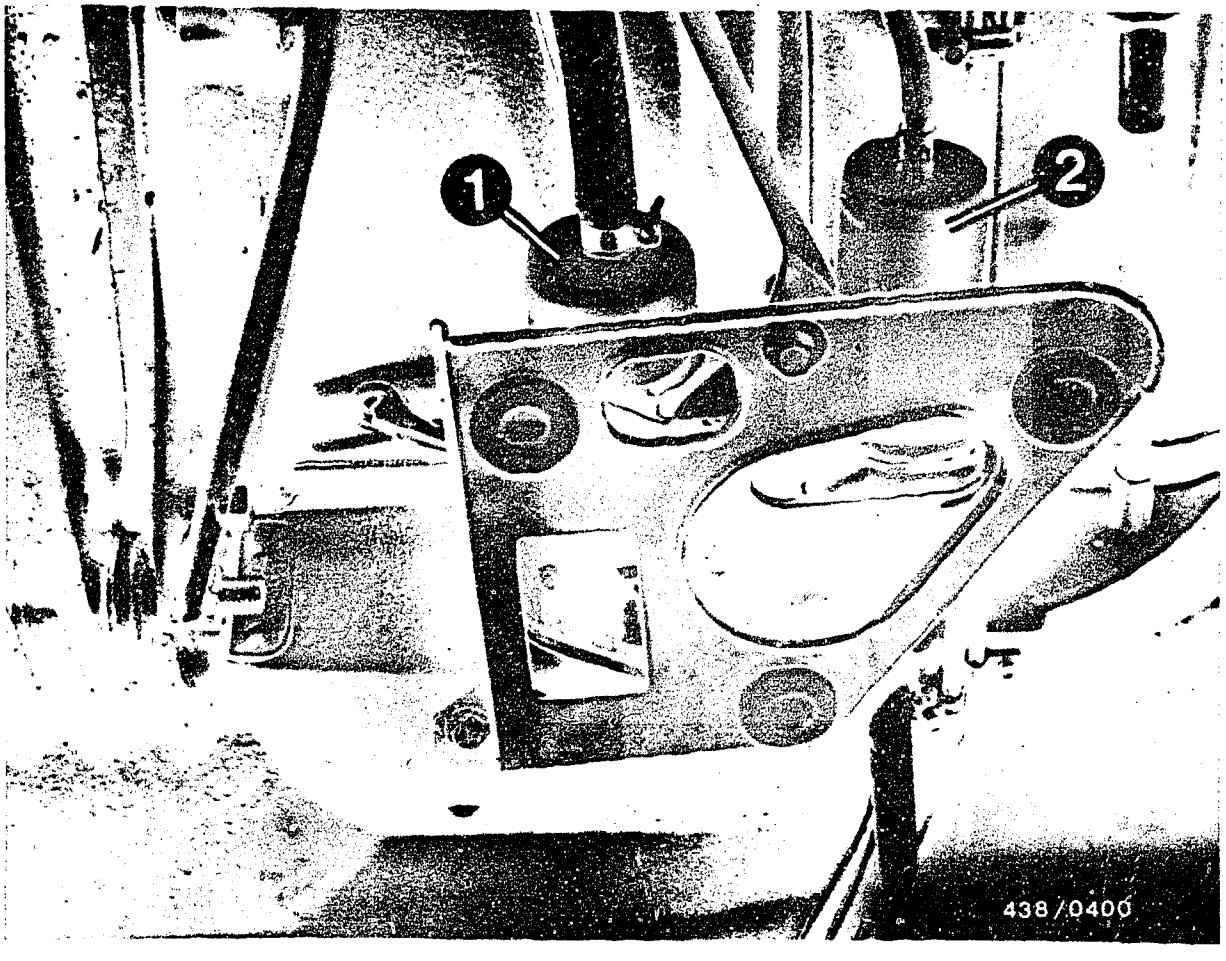
1 = Mixture-control unit
2 = Warm-up regulator
3 = Injection valves (cyl. 1 in the picture)
4 = Auxiliary-air device
5 = Start valve



As on the other Volvo models, the fuel filter (arrow) is located on the firewall (on the left-hand side as viewed from behind the vehicle).



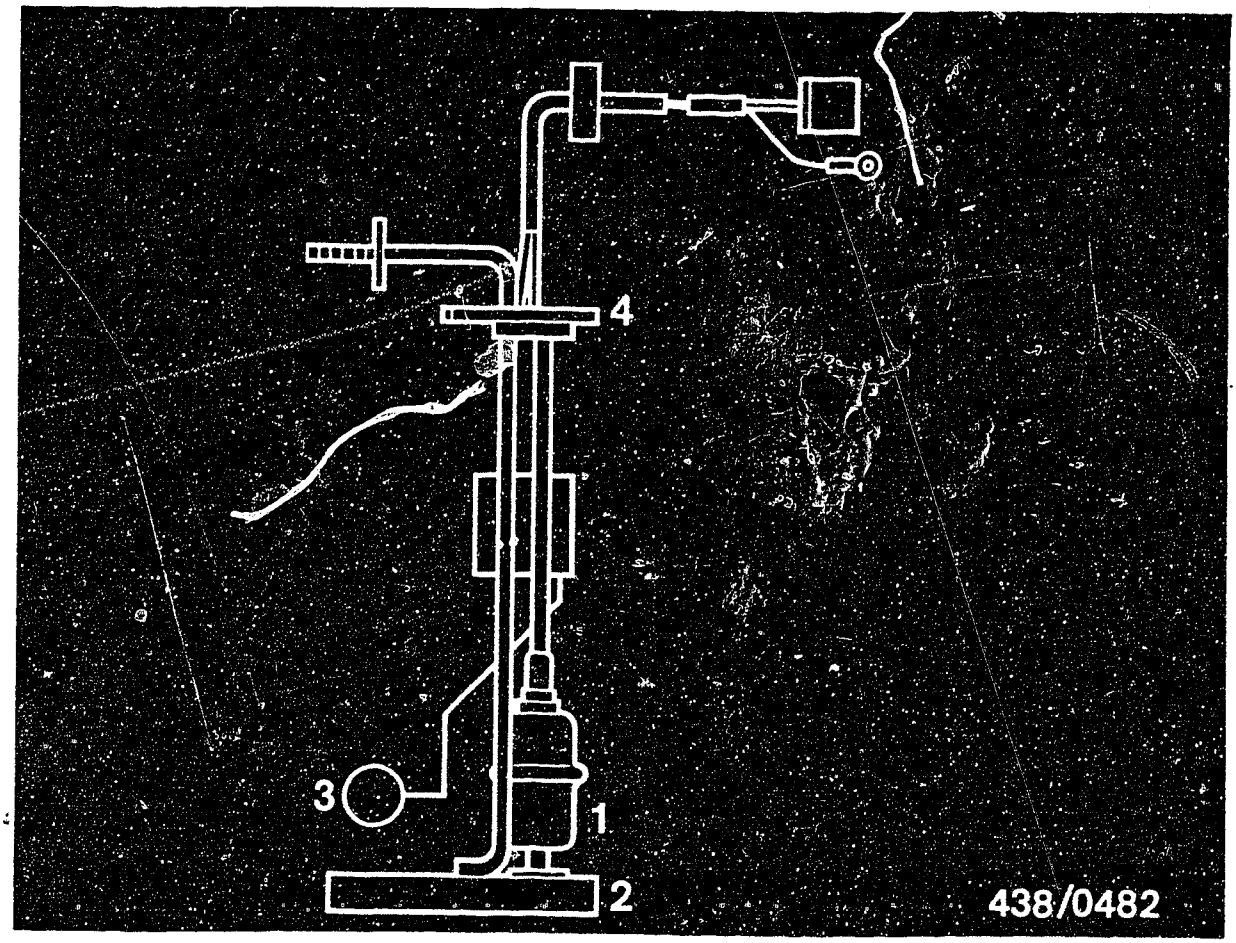
The thermo-time switch is screwed into the flange of the air-inlet port of cylinder 4 on the cylinder head.



Located on the floor of the vehicle (on the left-hand side as viewed from behind the vehicle) in front of the rear axle is a bracket on which are mounted the electric fuel pump (1) and the fuel accumulator (2).

The 1978/1979 models are equipped with the electric fuel pump of Type EKP I (with lateral delivery fitting).

As of the 1980 model, the Volvo models are equipped with electric fuel pumps of Type EKP IV (intake and delivery fittings central in the longitudinal direction of the pump).



1 = Pre-supply pump
2 = Intake filter
3 = Float for fuel-level pickup
4 = Fastening flange

The pre-supply pump installed in the Volvo (not made by Bosch) is combined into one unit with the pickup for indicating the fuel level. The pickup is made accessible by removing the luggage-compartment mat and the small cover fastened by two screws.

7. Trouble-shooting chart (see also Coordinates (B 3/B 4)

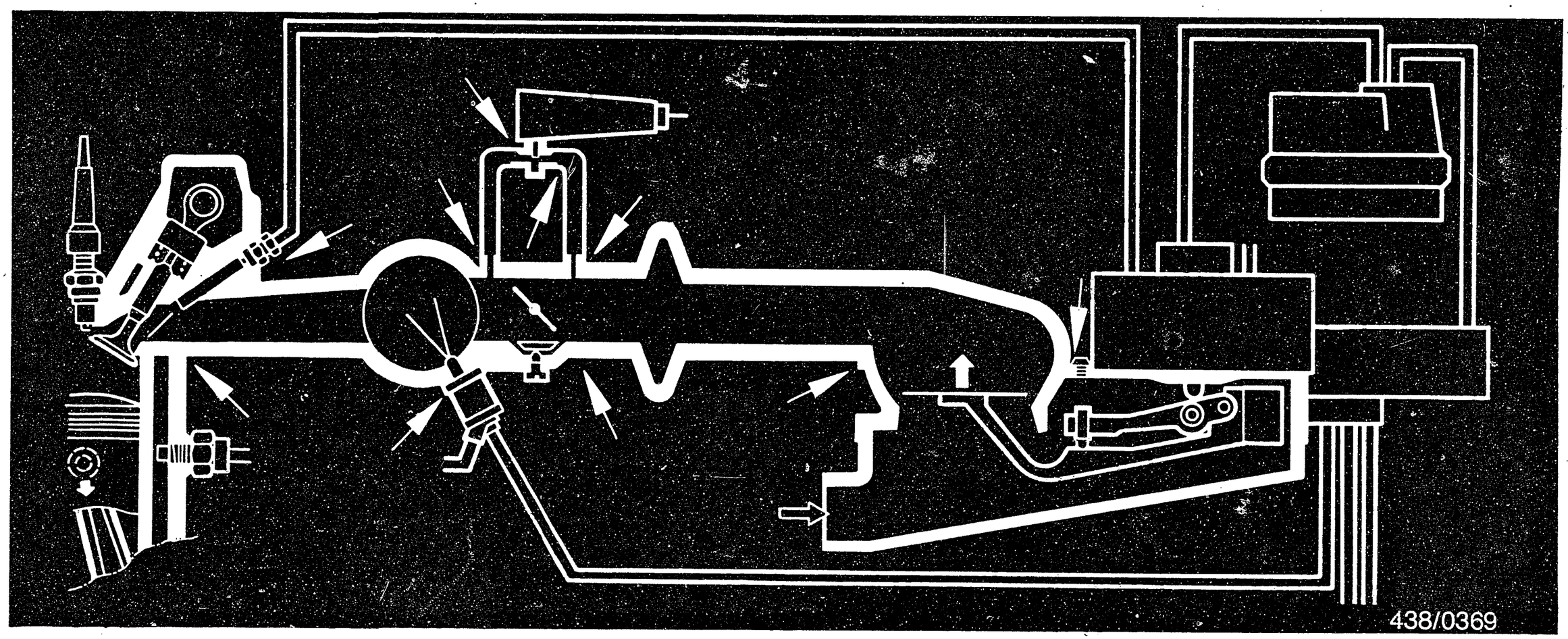
Customer complaint (fault symptom)

1. Engine does not start, or starts poorly, in cold condition
2. Engine does not start, or starts poorly, in warm condition*
3. Irregular idling during the warm-up phase (shakes)
4. Irregular idling with warm engine (shakes)
5. Engine does not draw gas, burbles
6. Engine misfires when operating on the road, high load
7. Insufficient power

*Note:
If, in the case of Symptom 2, after checking and repairing all the fault causes listed below, the hot-start characteristic is still unsatisfactory this can be improved by fitting an impulse relay.
The fitting of this relay is described in Coordinates L 4.

1	2	3	4	5	6	7	Cause	Coordinates
	●	●	●	●		●	Vacuum system leaking	B 5
●	●		●	●	●	●	Air-flow sensor lever and/or control plunger not moving smoothly	B 7
	●						Position of the air-flow sensor plate incorrect	B 18
●		●					Auxiliary-air device does not open	B 22
●	●				●		Electric fuel pump not operating	C 1
●							Cold-start system defective	C 13
		●	●				Cold-start valve leaking	C 16
				●			Excessive fuel delivery for control-pressure circuit	C 20
●		●					"Cold" control pressure outside tolerance	C 18
	●		●	●	●	●	"Warm" control pressure too high (after warm-up)	C 18
			●	●		●	"Warm" control pressure too low (after warm-up)	D 11
					●	●	Primary (system) pressure outside tolerance	D 11
	●						Overall fuel system leaking	D 19
●	●	●	●		●		Injection valves leaking, opening pressure too low	E 18
●	●	●	●			●	Unequal fuel delivery (imbalance of fuel delivery)	F 6
●	●	●	●	●			Basic idle adjustment incorrect	F 19
						●	Throttle plate does not open completely	---

8. Engine runs on after being switched off ("diesels")	9. Fuel consumption too high	10. Flat spot during acceleration	11. CO concentration during idling too high	12. CO concentration during idling too low	13. Idle-speed cannot be adjusted (too high)	14. Engine starts but then immediately stops	Cause	Coordinates
		●		●			Vacuum system leaking	B 5
●		●	●	●			Air-flow sensor and/or control plunger not moving smoothly	B 7
●							Position of the air-flow sensor plate incorrect	B 16
							Auxiliary-air device does not open	B 22
					●		Auxiliary-air device does not close	B 22
						●	Electric fuel pump not operating	C 1
							Cold-start system defective	C 13
●	●		●				Cold-start valve leaking	C 16
		●				●	Excessive fuel delivery for control-pressure circuit	C 20
		●				●	"Warm" control pressure too high (after warm-up)	C 18
	●	●	●			●	"Warm" control pressure too low (after warm-up)	C 18
		●				●	Primary (system) pressure outside tolerance	D 11
							Overall fuel system leaking	D 19
●							Injection valves leaking, opening pressure too low	E 18
		●					Unequal fuel delivery (imbalance of fuel delivery)	F 6
●	●	●	●	●			Basic idle adjustment incorrect	F 19
							Throttle plate does not open completely	---



Working steps

8. Check the air-intake system of the engine for leaks.

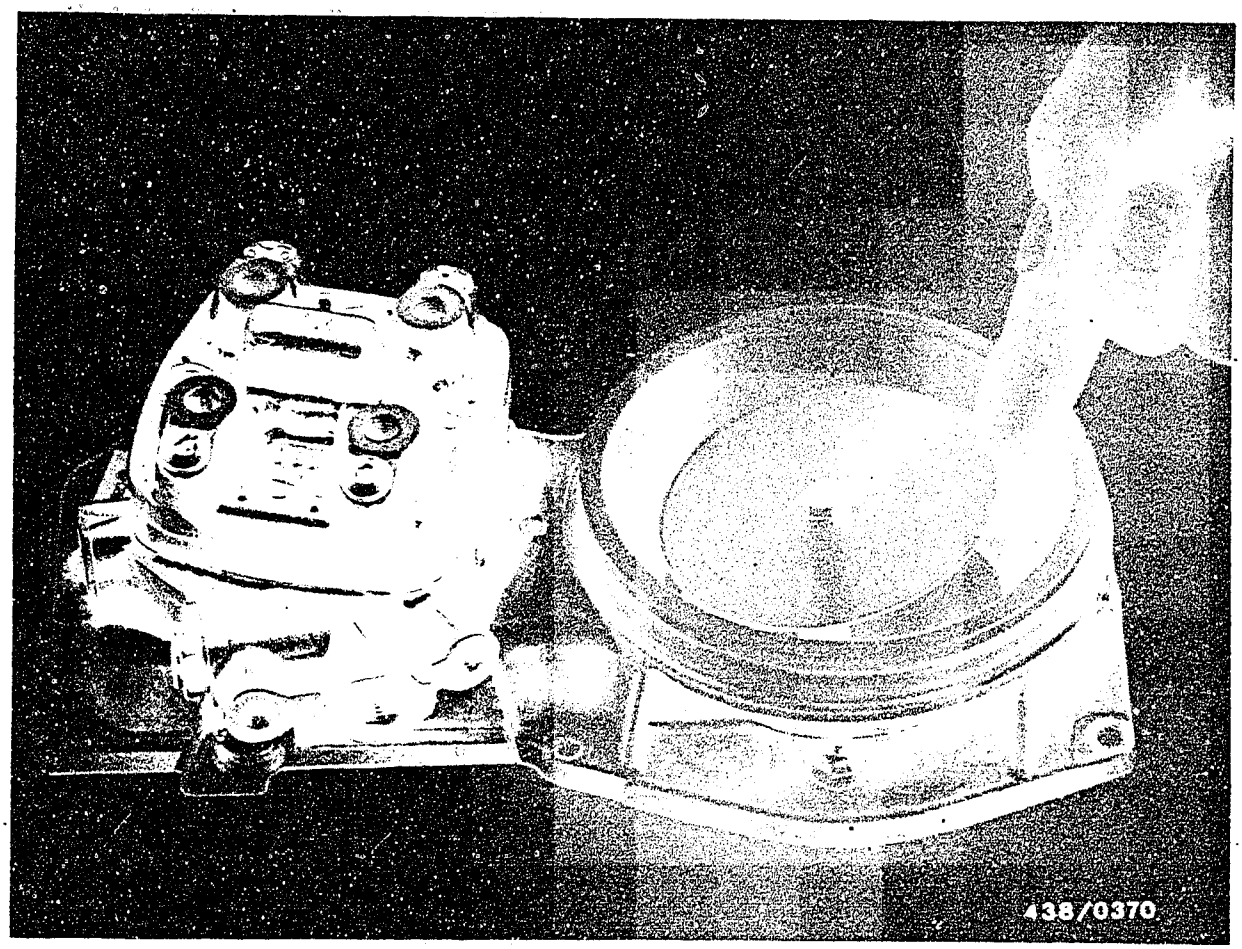
The arrows in the diagram show typical points where leaks can occur.
Check by performing a visual inspection or, in cases of doubt, as follows: Disconnect the hose from the outlet of the auxiliary-air device and blow air through this hose into the intake system using a compressed-air gun. The throttle valve is to be fully open. Brush connection points with soapy water, or spray with leak detector (e.g. Güpoflex).

Under no circumstances may combustible liquids be used when testing for leaks.
The formation of bubbles or foam indicates a leak.
If a leak has been eliminated, it is necessary finally to adjust the idle speed with the engine at normal operating temperature:
Idle-speed adjustment is described on Coordinates F 19.

9. Check the control lever in the air-flow sensor and the control plunger in the fuel distributor for ease of movement.

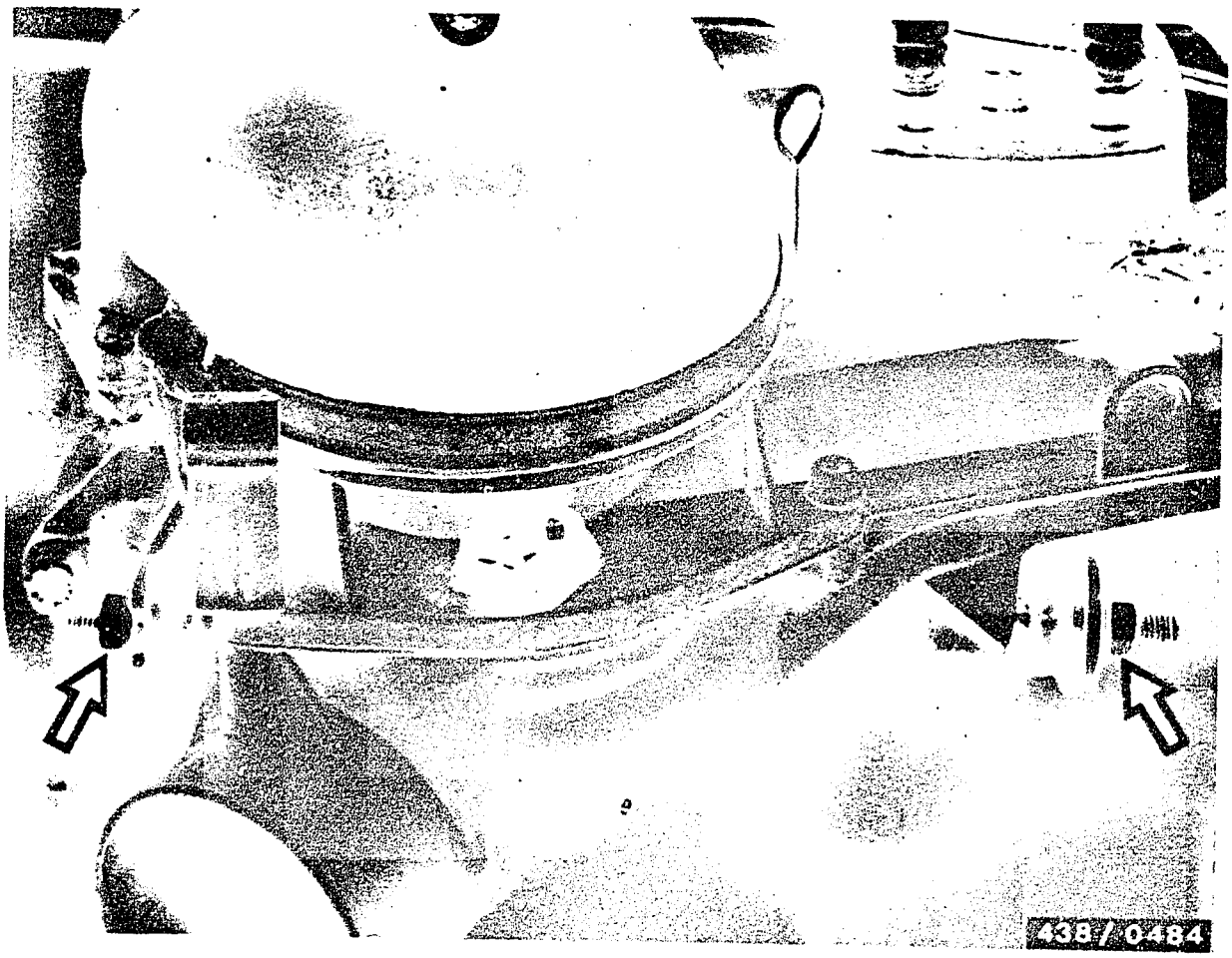
9.1 Preparations

- Engine temperature not below +20°C.
- Remove the rubber hood so that the air-flow sensor plate becomes accessible.
- Switch on the electric fuel pump for approx. 10 seconds by bridging the safety circuit.
 This results in application of the control pressure to the control plunger in the fuel distributor.



9.2 Check that the control lever moves freely

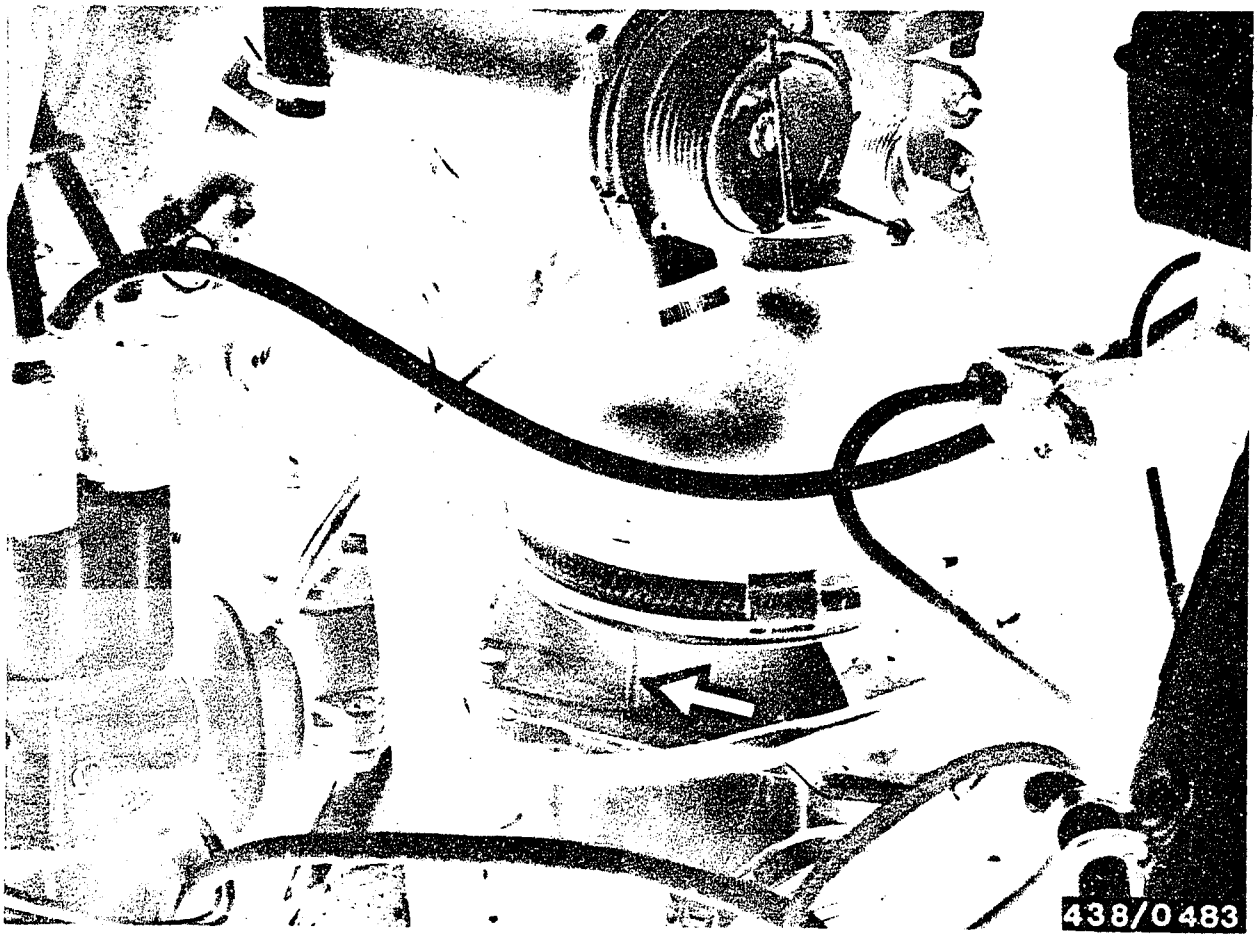
Raise the air-flow sensor plate by hand (updraft) and release again. The sensor plate snaps back into the zero position and bounces up about twice from the spring-loaded stop. If the control lever does not move freely, first release all fastening screws holding the air-flow sensor to determine whether housing deformation is the cause of the problem.
If the problem is solved by loosening the fastening screws, the seal between the air-supply housing and air-flow sensor should be changed (Volvo parts).
Tighten the screws uniformly cross-wise to a torque of 9...10 Nm (0.9...1.0 kgfm).
If the housing is not deformed, then the air-flow sensor must be repaired or replaced.



9.3 Removing and installing the air-flow sensor and the complete mixture-control unit:

Since the rear fastening screws of the mixture-control unit are not readily accessible, it is a good idea to remove the mixture-control unit together with the bracket.

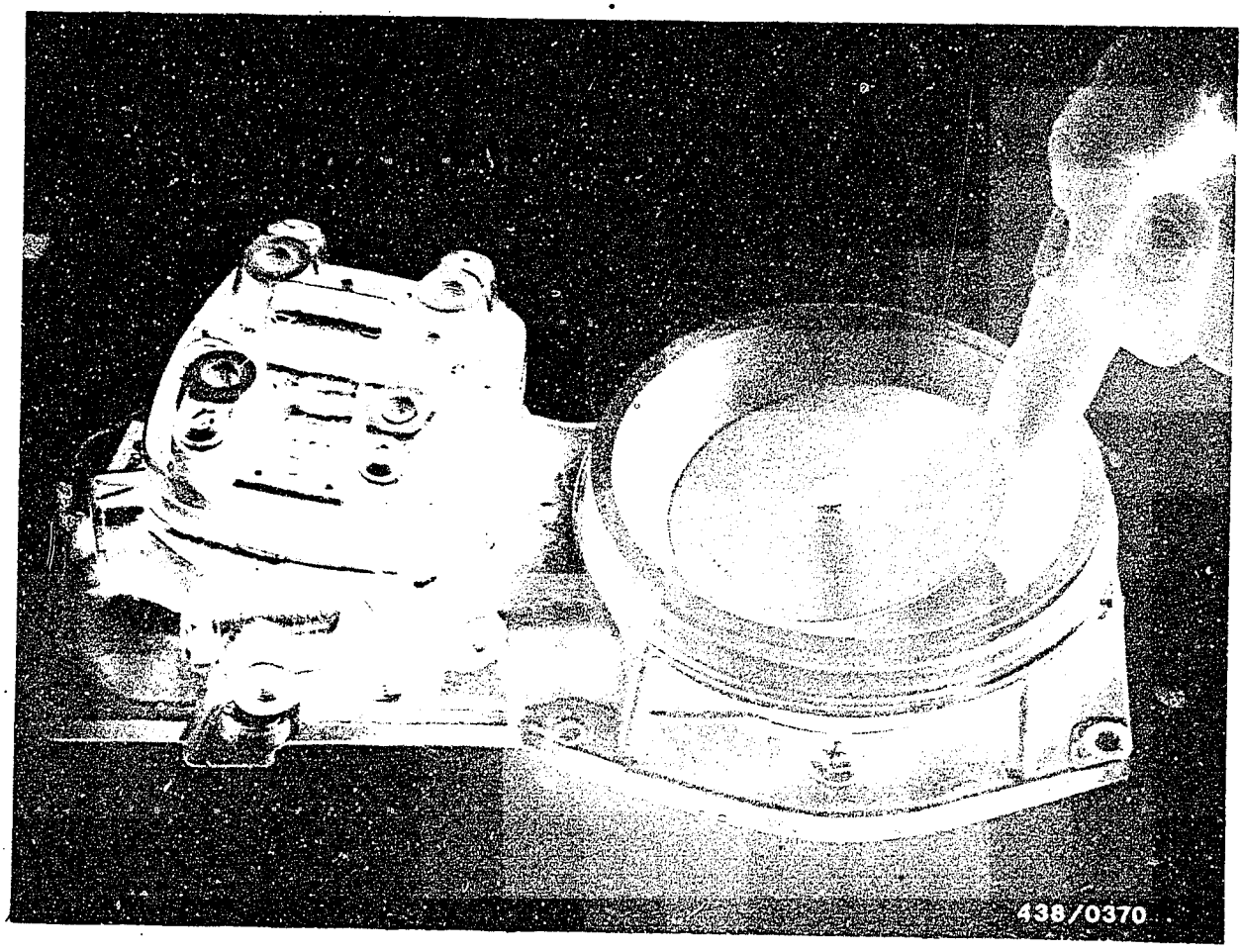
Sequence of operations:
Remove the air-guide hose between air filter and bracket.
Remove the connection dome between air-flow sensor and throttle-valve assembly.
Remove the plug from the air-flow sensor and unscrew all fuel lines from the fuel distributor.
Unscrew the fastening nuts on the rubber-bonded metal buffers (arrows) of the bracket and remove the bracket together with the mixture-control unit.



If the mixture-control unit has been removed from the bracket, then use a new seal when installing.
Tighten the fastening screws of the mixture-control unit uniformly.

Install in the reverse order. Always install the fuel lines with new seal rings.

Install the connection dome between air-flow sensor and throttle-valve assembly so that the arrow points to the reinforcing rib in the air-flow sensor housing (arrow).



9.4 Check that the control plunger moves freely

Raise the air-flow sensor plate by hand (updraft). The same resistance must be felt over the entire movement.

Move the sensor plate rapidly back to a position just in front of the zero stop. The control plunger follows only sluggishly, but must make noticeable contact with the sensor plate lever. If this condition is fulfilled, the control plunger can be considered to move freely.

If the control plunger does not move freely, remove the fuel distributor from the air-flow sensor.

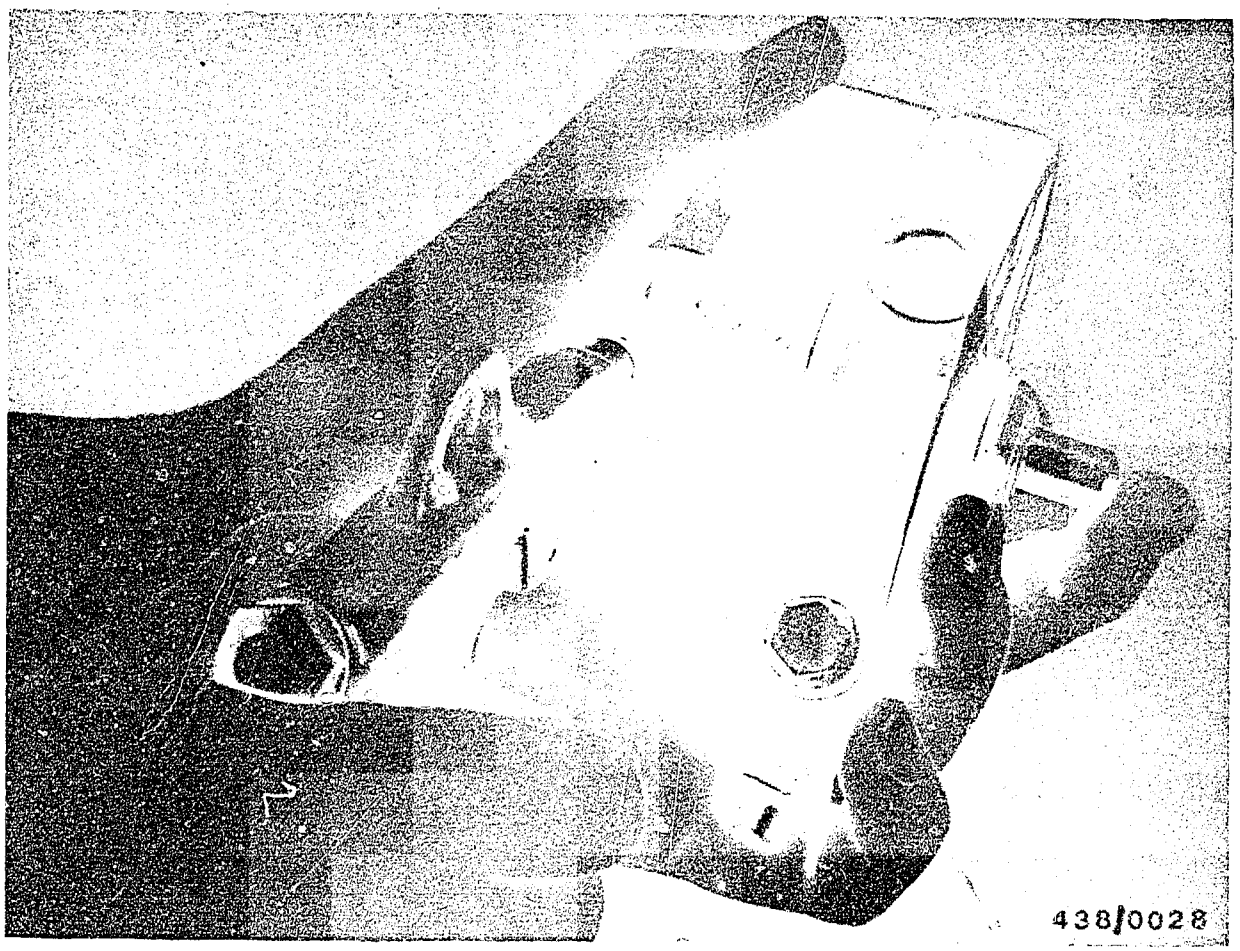
Important!

Note the following when installing fuel components and fuel lines:

Always ensure utmost cleanliness when loosening or tightening the fuel connections. No dirt must enter the fuel system.

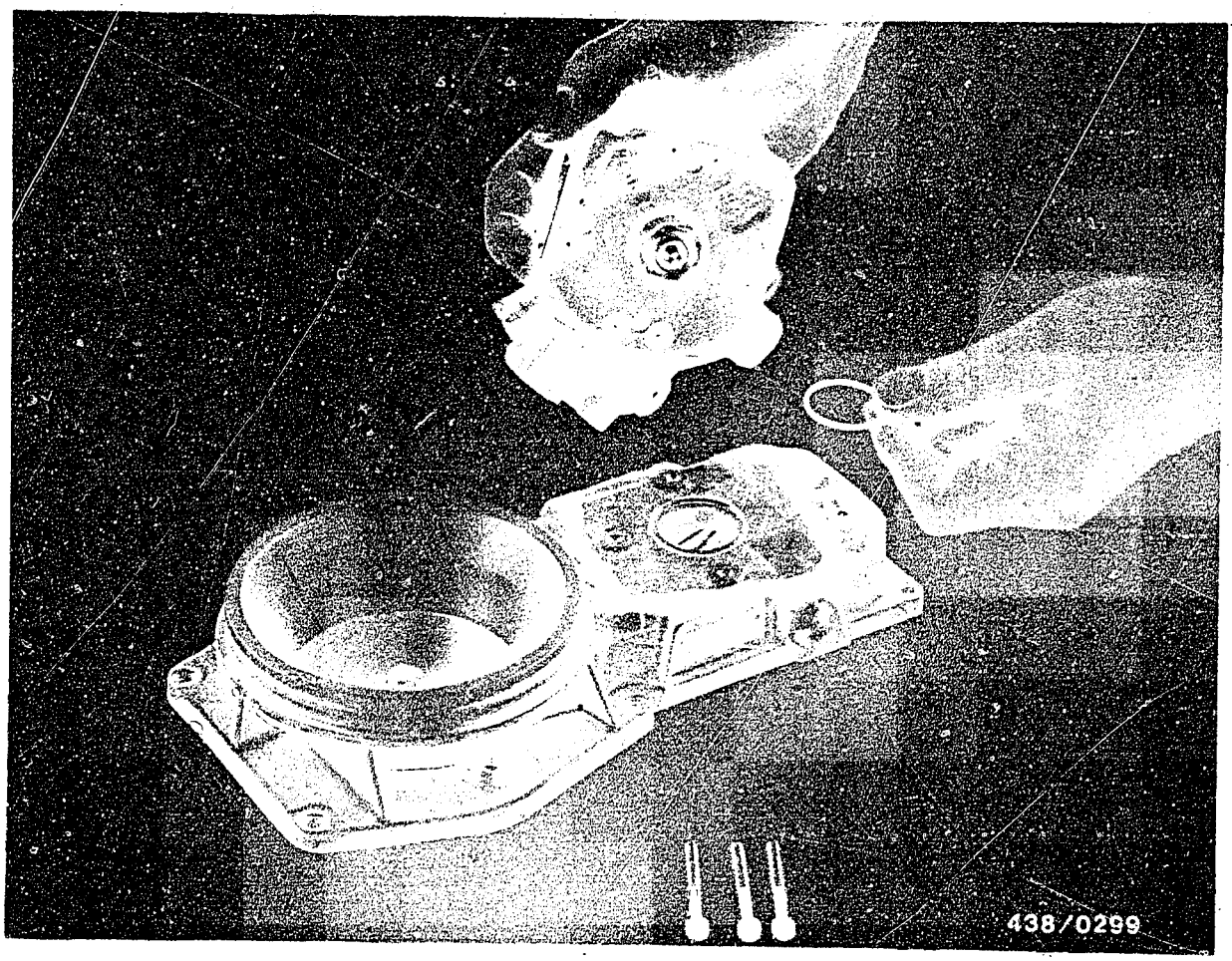
When loosening or tightening the fuel connections, apply counter-force at the fixed hexagon of the component.

Clean the fuel distributor thoroughly in the region of the fuel connections. Screw off all connections.



Screw out three fastening screws and remove the fuel distributor from the air-flow sensor.

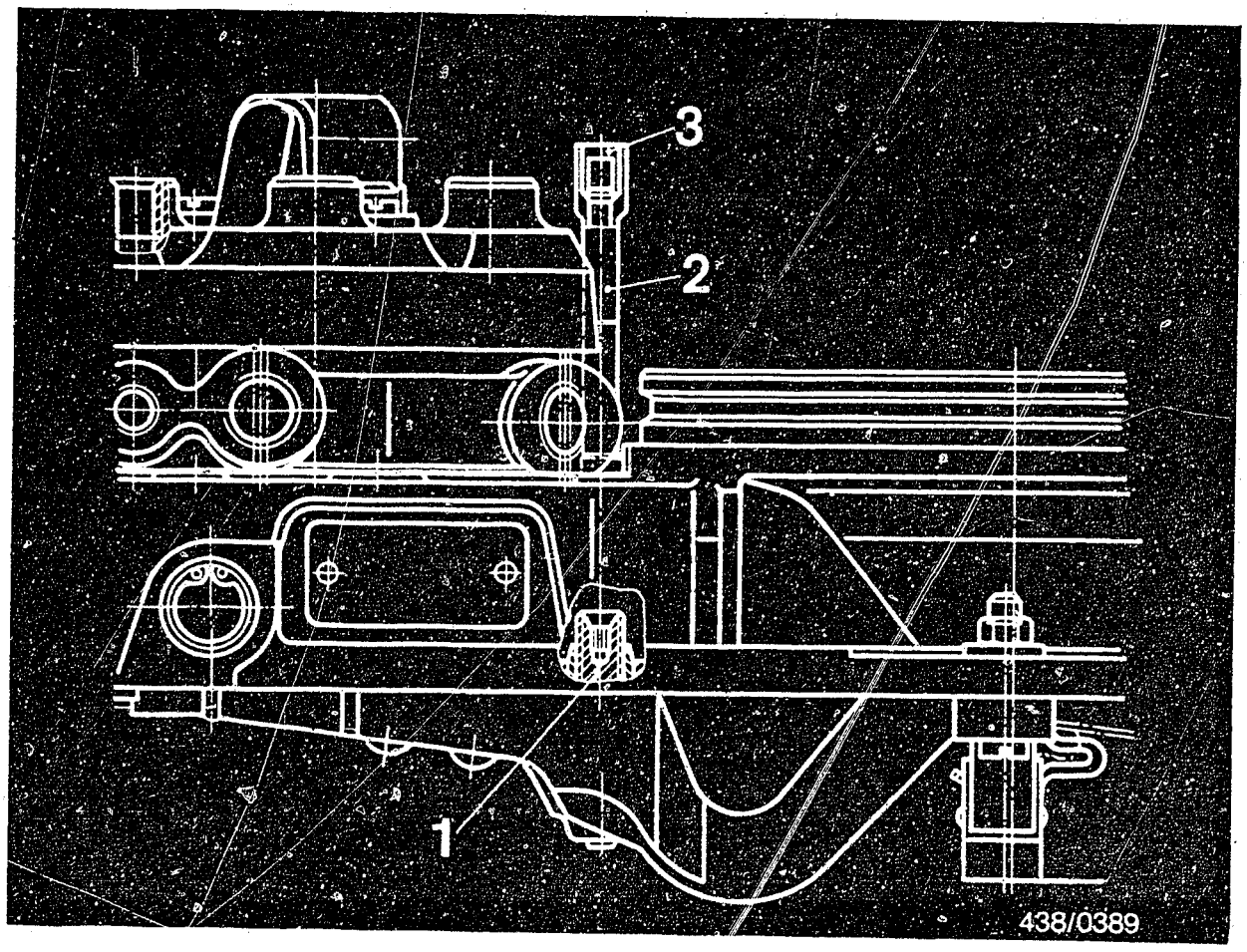
Remove the plunger. Under certain conditions, in order to do this it may be necessary to blow compressed air briefly against the plunger through the control-pressure connection hole. Hold the plunger with your hand while doing this. Clean the plunger thoroughly with benzine. If the plunger still does not move freely, replace the fuel distributor



9.5 Fitting the fuel distributor

When fitting the fuel distributor, use a new seal ring between fuel distributor and air-flow sensor. Observe the tightening torque 3.2...3.8 Nm (0.32... 0.38 kgfm) for the fastening screws precisely.

When connecting the fuel-injection tubing, use new seal rings.

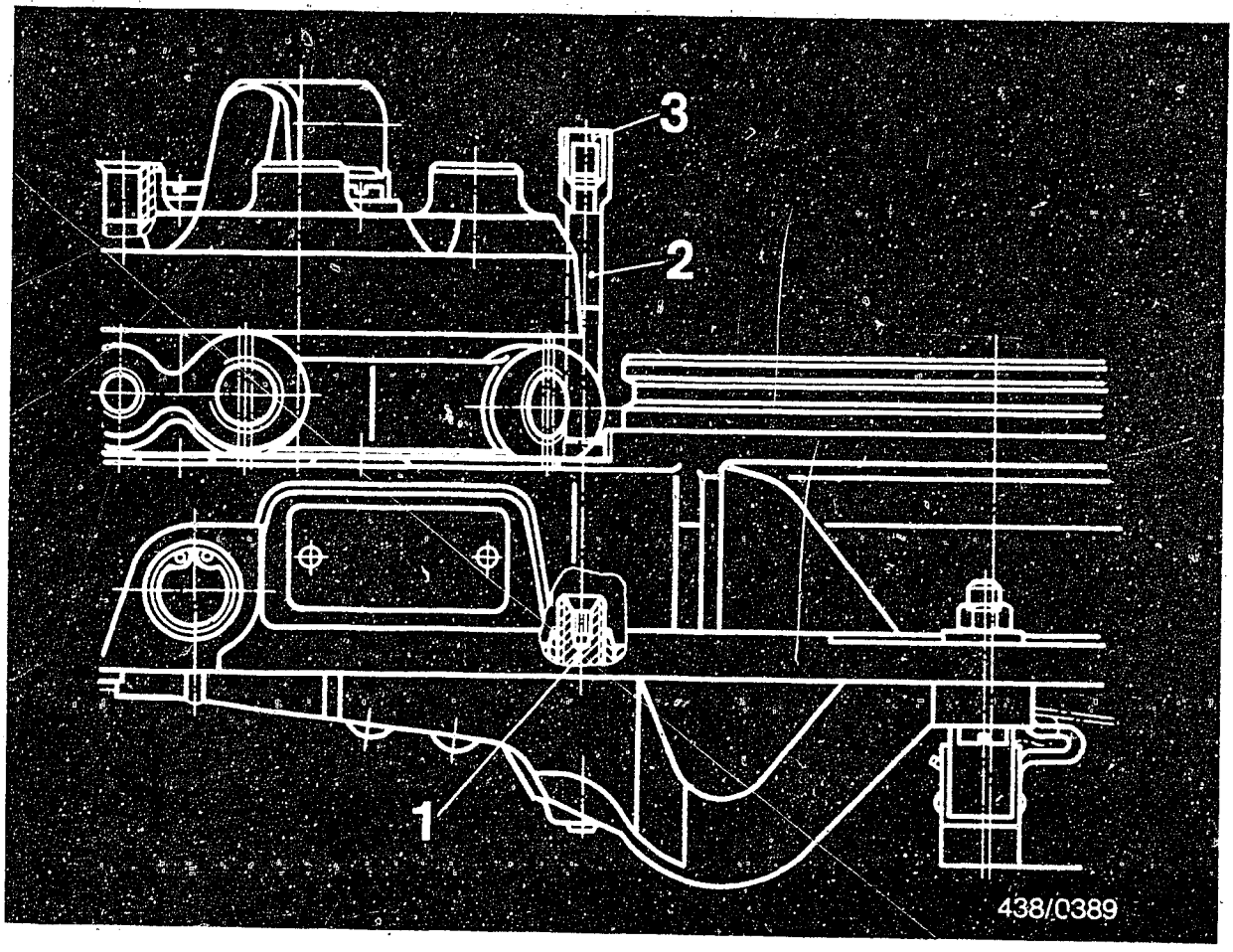


1 = Mixture-control screw
2 = Guide tube
3 = Lead seal

9.6 Matching the fuel distributor to the air-flow sensor for initial starting

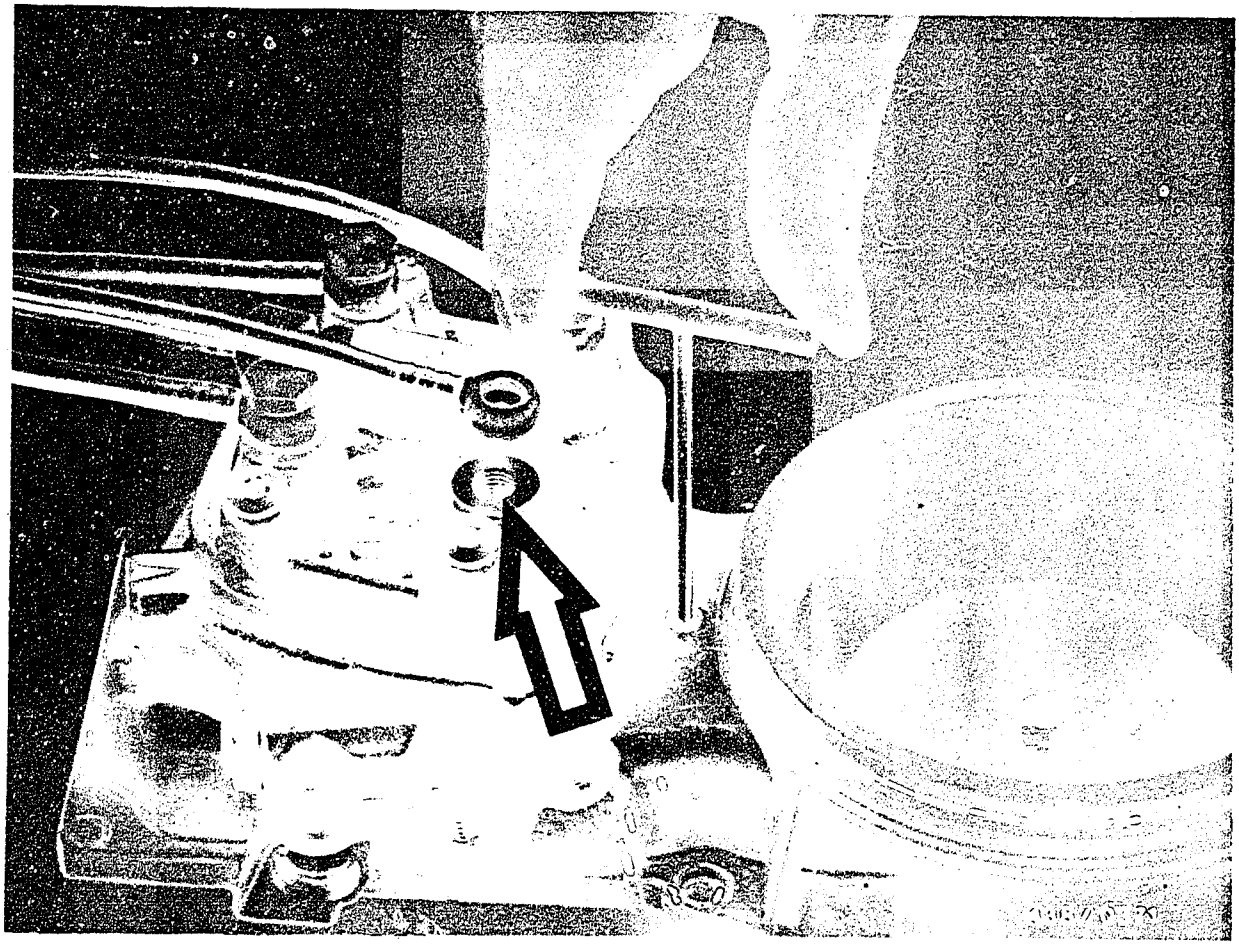
Screw off one fuel-injection line from the fuel distributor.
Bridge the electrical safety circuit so that the electric fuel pump operates.

The idle-mixture-adjusting screw is adjusted via a guide tube rigidly fitted on the mixture-control unit.



1 = Idle-mixture-adjusting screw
2 = Guide tube
3 = Lead seal

Remove anti-tamper device (lead seal) of the idle-mixture-adjusting screw. Introduce adjusting wrench KDEP 1035 through the hole into the idle-mixture-adjusting screw.



Screw in the idle-mixture-adjusting screw slowly and without exerting any great pressure on the adjusting wrench until fuel is just delivered from the open outlet (arrow) of the fuel distributor. Then turn back the idle-mixture screw by 1/2 turn.

Re-connect the fuel-injection line to the fuel distributor, start the engine and warm up.

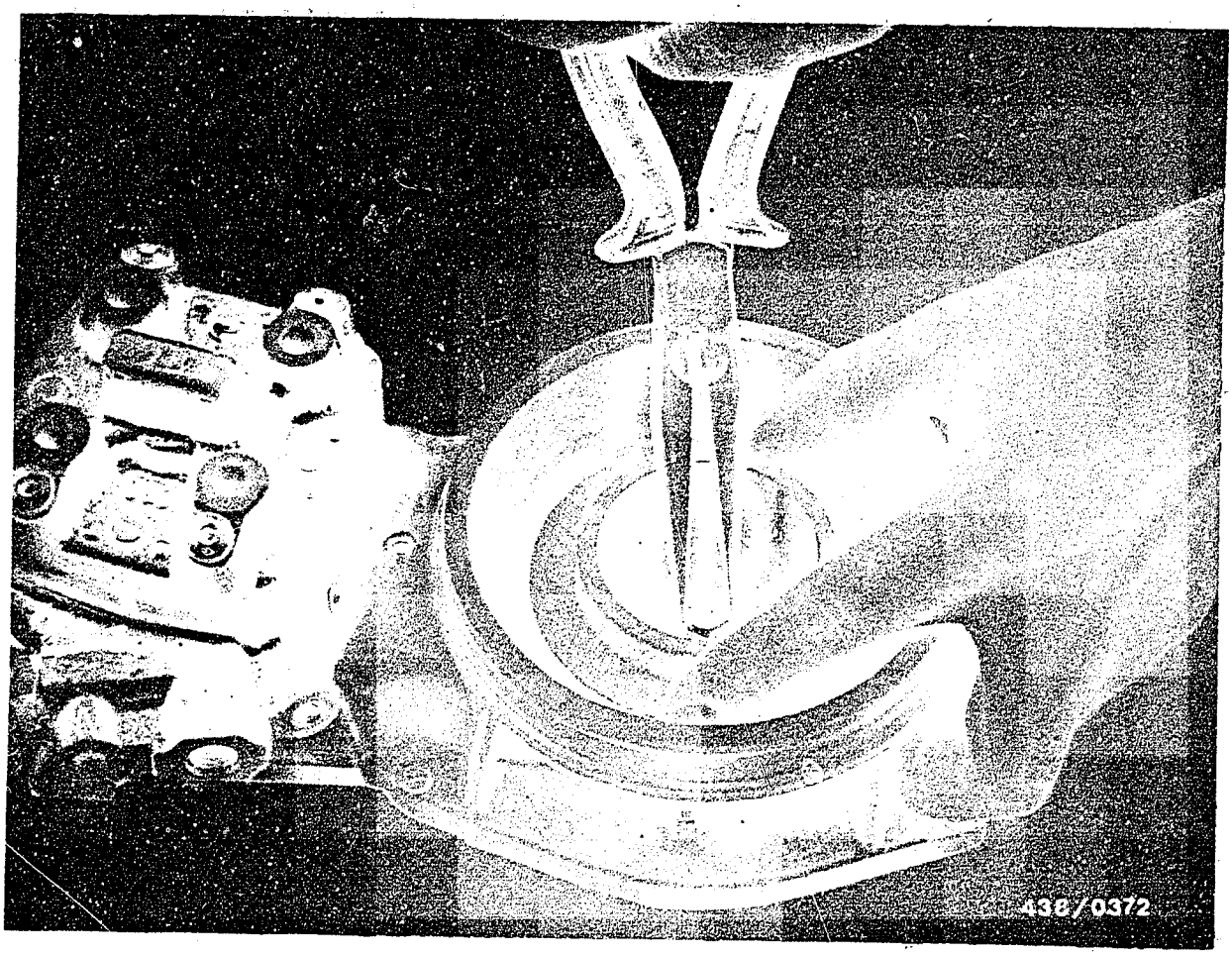
The final matching of air-flow sensor and fuel distributor is carried out by adjusting the idle speed with the engine at normal operating temperature.

Idle-speed adjustment is described on Coordinates F 19.

10. Checking and adjusting the position of the air-flow sensor plate

10.1 Preparations

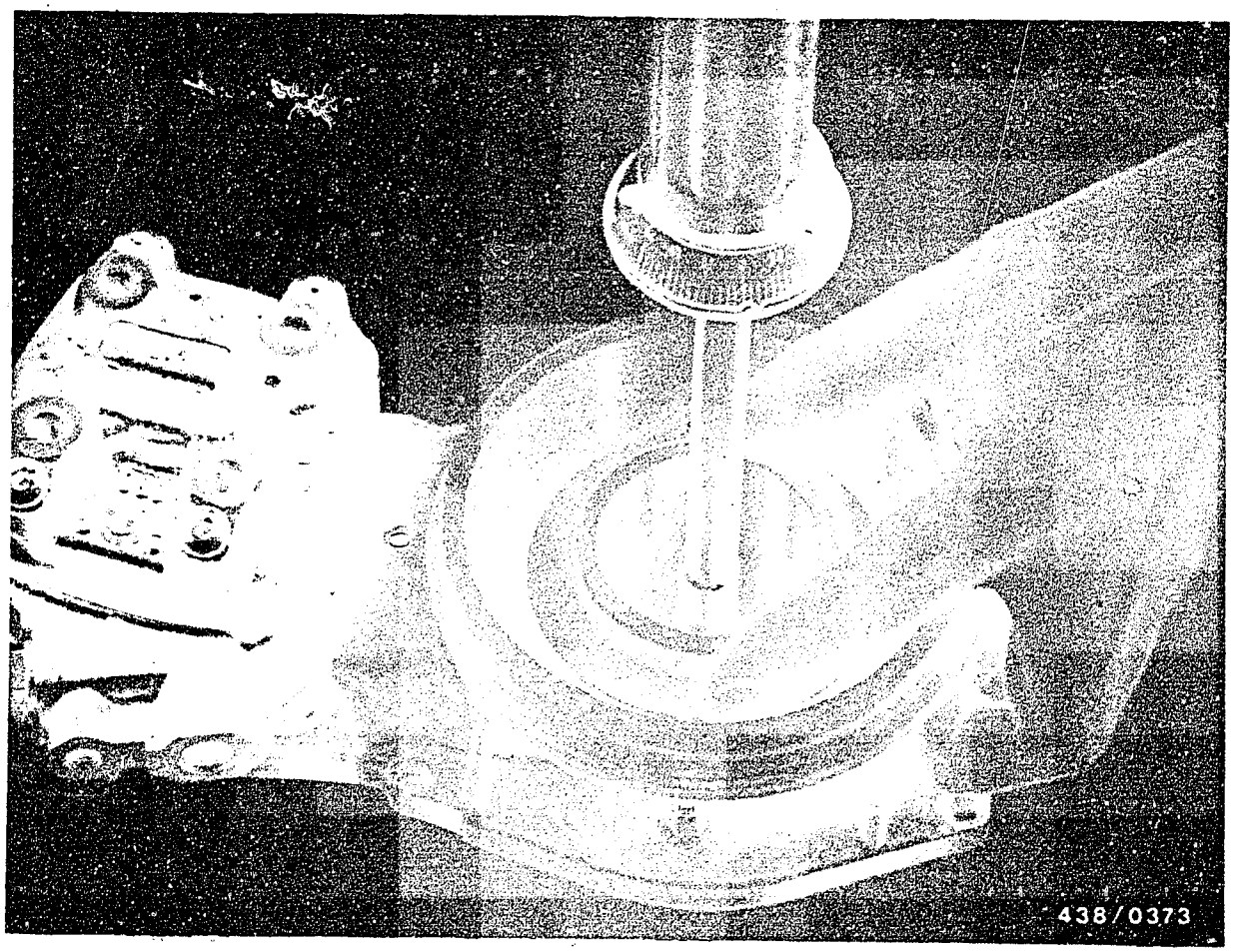
- Engine temperature is not important.
- Remove the rubber hood fitted between the air-flow sensor and the throttle-valve assembly (release 2 clamping bands), so that the air-flow sensor plate becomes accessible.



10.2 Centering the air-flow sensor plate

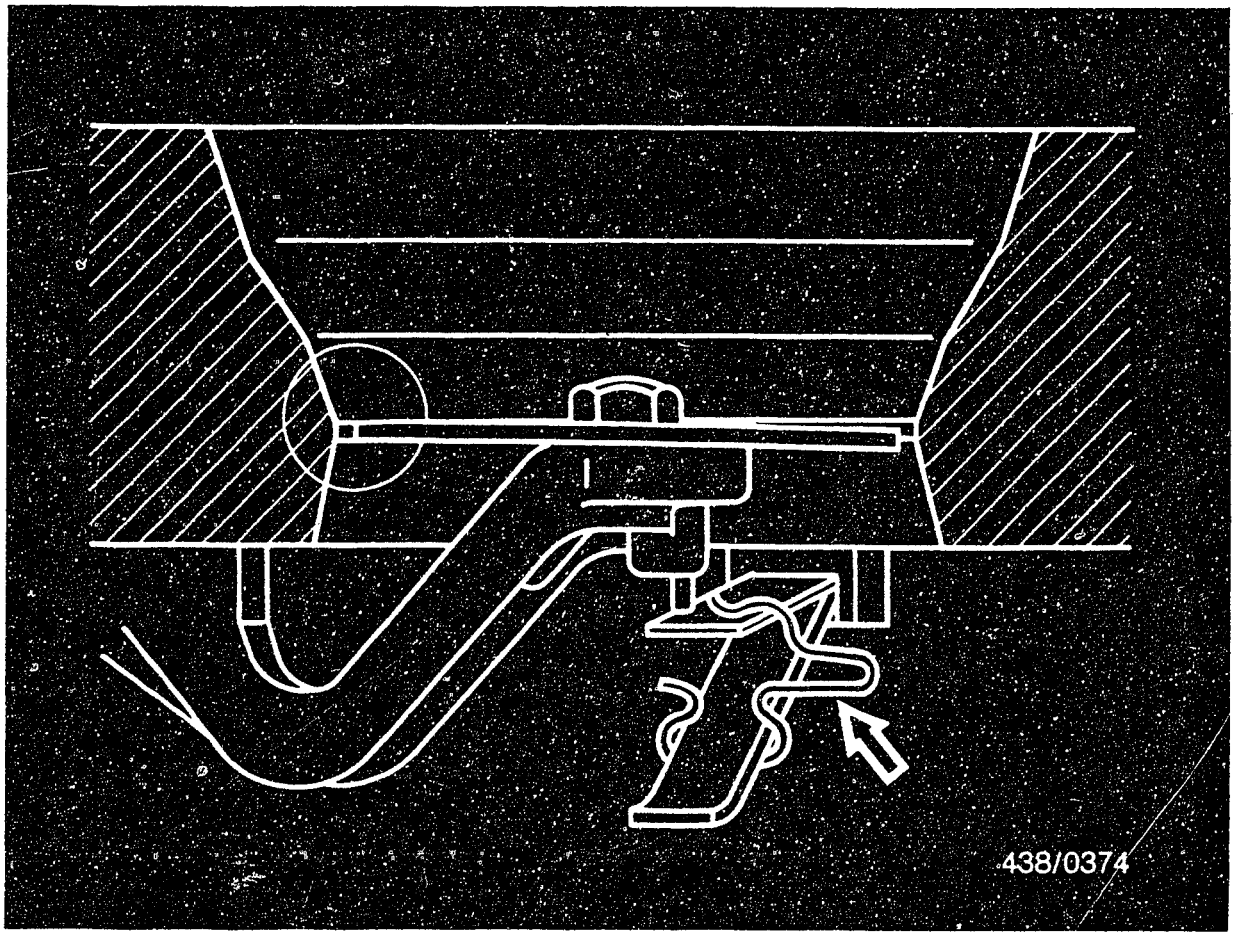
Check that the sensor plate is flat (not bent) and that it can move through the narrowest part of the air funnel without touching the funnel. If necessary, center it using a positioning ring KDEP 1040/10 (dia. 80 mm) as follows:

Loosen the sensor plate fastening screw. Insert the positioning ring while holding the fastening screw with pliers so that the sensor plate does not deflect downwards.



With the positioning ring in place, tighten the fastening screw with a torque of 5.0...5.5 Nm, loosen again and tighten again with the same torque.
When tightening the screw make sure that the air-flow sensor plate is in zero position (in the cylindrical part of the air funnel).
It must no longer be possible to turn the air-flow sensor plate by hand.

Caution:
The lower edge of the sensor plate is partially chamfered. In order to ensure correct mounting of the sensor plate its upper side is marked by five punch marks in a row.

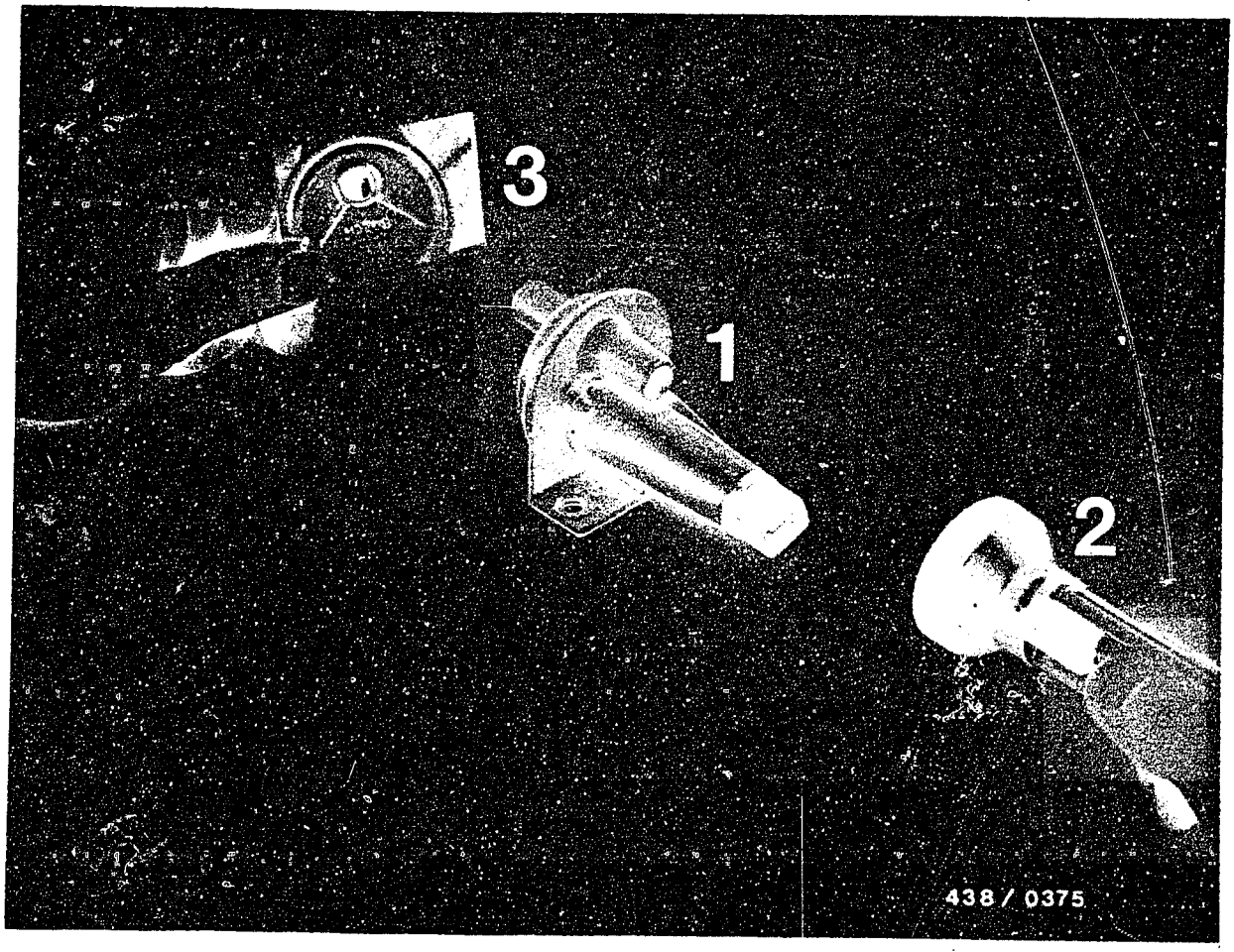


10.3 Checking and adjusting the zero position of the sensor plate (rest position):

Switch on the electric fuel pump for approx. 10 seconds by bridging the safety circuit.
This results in application of the control pressure to the control plunger in the fuel distributor.

The upper edge of the sensor plate must be flush with the cone in the position marked with a circle in the picture. A lower position of up to maximum 0.5 mm is permissible, however the air-flow sensor plate must not project at any point on its circumference outside the cylindrical part of the air funnel.

If necessary, the position of the leaf-spring limit-stop can be corrected by adjusting the shaped spring (arrow).



1 = Auxiliary-air device
2 = Flashlight
3 = Mirror

11. Checking the operation of the auxiliary-air device.

The engine must be cold.
Disconnect the electric cable plugs from the auxiliary-air device and warm-up regulator.
Disconnect both air hoses from the auxiliary-air device. Since the two hose fittings on the auxiliary-air device are located exactly opposite each other, a visual check can now be made to see if the blocking plate is partially open.
It will be easier to look through the auxiliary-air device with the aid of a flashlight and a mirror, as shown in the illustration.

- If an opening is not visible with the engine cold, replace the auxiliary-air device.

- Fit the electric cable plug on the auxiliary-air device.

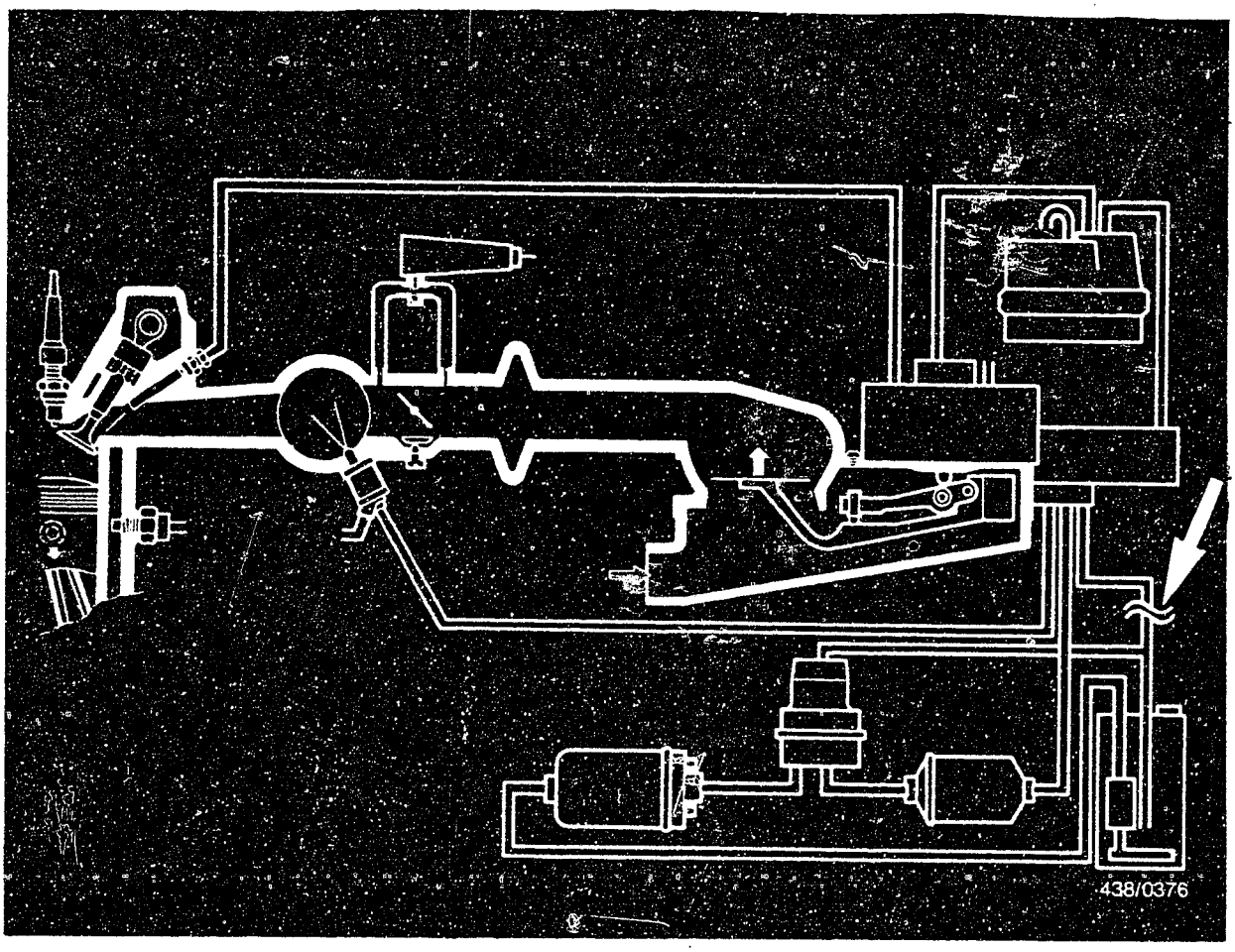
- By bridging the electrical safety circuit, supply power to the auxiliary-air device.
 After a maximum of 10 minutes, the opening in the auxiliary-air device must be completely closed by the blocking plate.

- If the blocking plate does not close, check the power supply (open circuit, voltage drop).
 Minimum voltage across the connector 11.5 V with the engine stopped.

- If these points are O.K., check the heating coil of the auxiliary-air device for an open circuit using an ohmmeter.

- Replace the auxiliary-air device if defective.

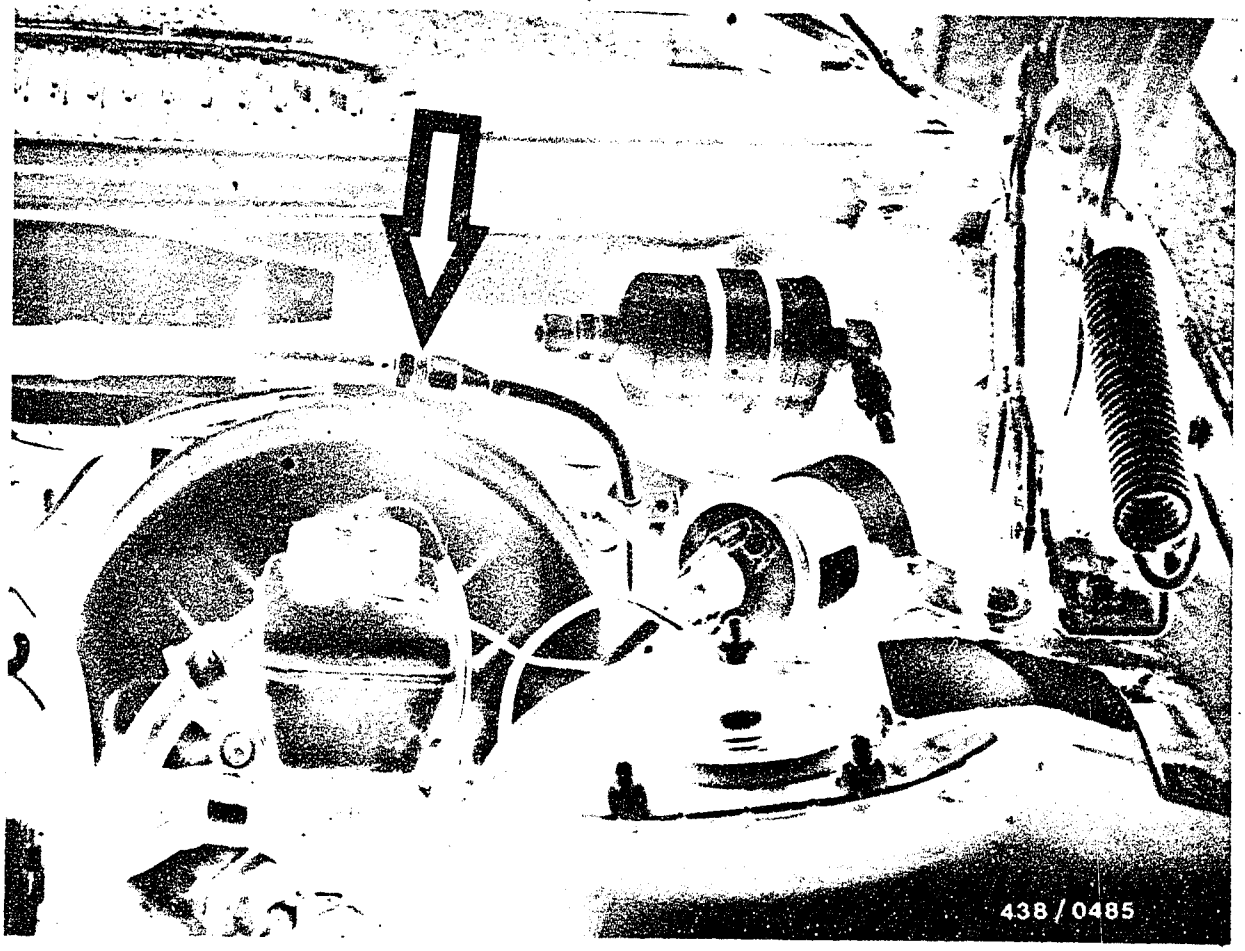
When the auxiliary-air device has been replaced, readjust the idle speed with the engine at normal operating temperature. Idle adjustment is described on Coordinates F 19.



12. Checking the operation of the electric fuel pump

12.1 Requirement

Conclusive information on the operation of the electric fuel pump can only be given by a measurement of fuel delivery under pressure, i.e. under primary (system) pressure. This measurement must therefore be made at the return line leading to the fuel tank (arrow).



12.2 Measuring point:

A suitable measuring point for testing the fuel delivery is the screw connector (arrow) in the fuel return line to the fuel tank.
Undo the connector and hold the hose (coming from the fuel distributor) in a graduate (approx. 1.5 litres capacity) in order to make the measurement.

12.3 Testing:

Remove the plugs from the warm-up regulator and auxiliary-air device.

Switch on the electric fuel pump for precisely 30 seconds by bridging the safety circuit and measure the delivery in a graduate.

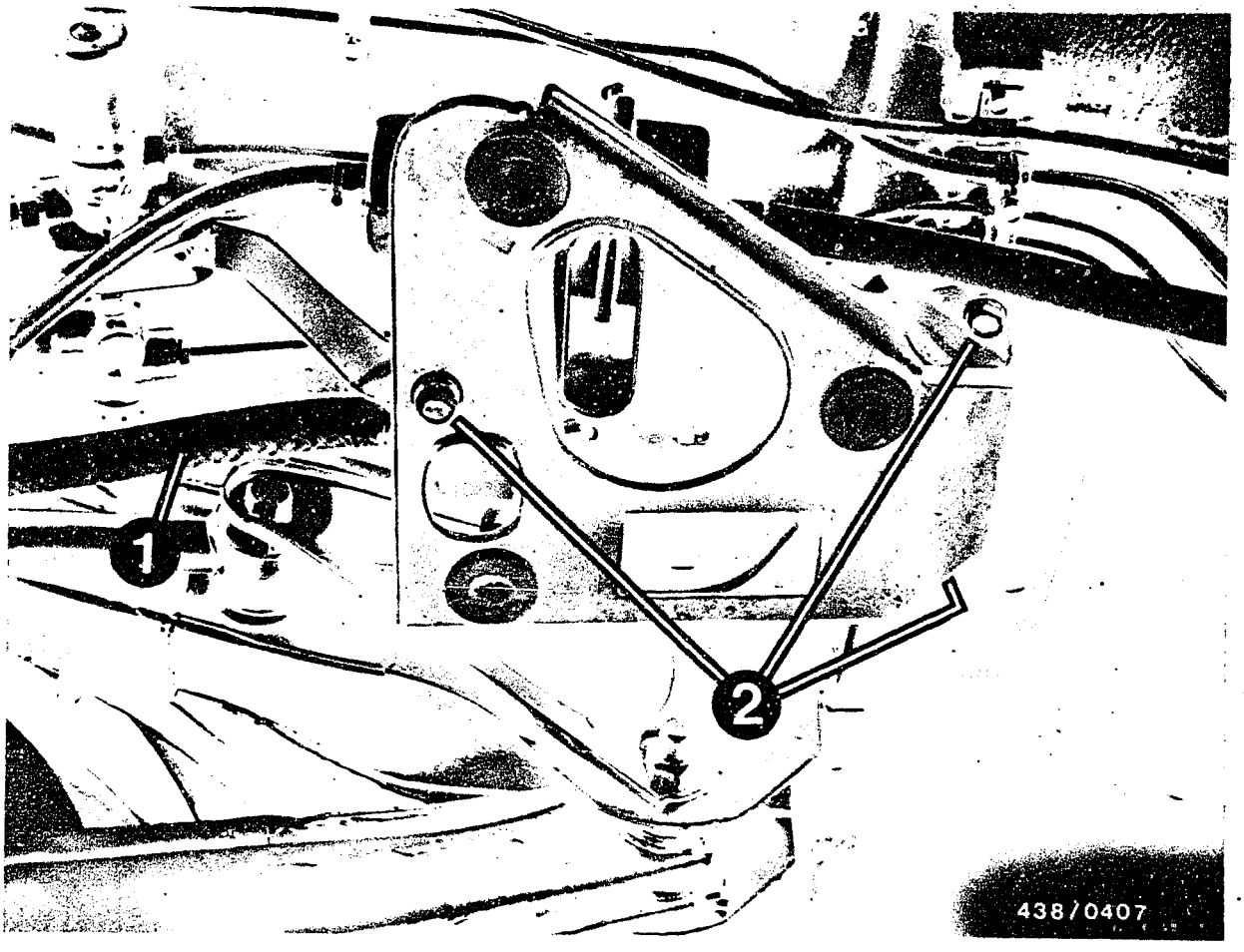
12.4 Test specification

Fuel delivery: min. 750 cm^3/30 seconds

12.5 Possible causes of insufficient fuel delivery:

- Power supply to the electric fuel pump defective, voltage drop.
 Necessary minimum voltage at terminal with pump operating = 11.5 V.
- Fuel filter very dirty.
- Pre-supply pump not operating.
 Carry out noise test, if necessary with the main electric fuel pump switched off.

If the above-mentioned points are O.K., the cause lies with the electric fuel pump itself.
Replace the electric fuel pump.

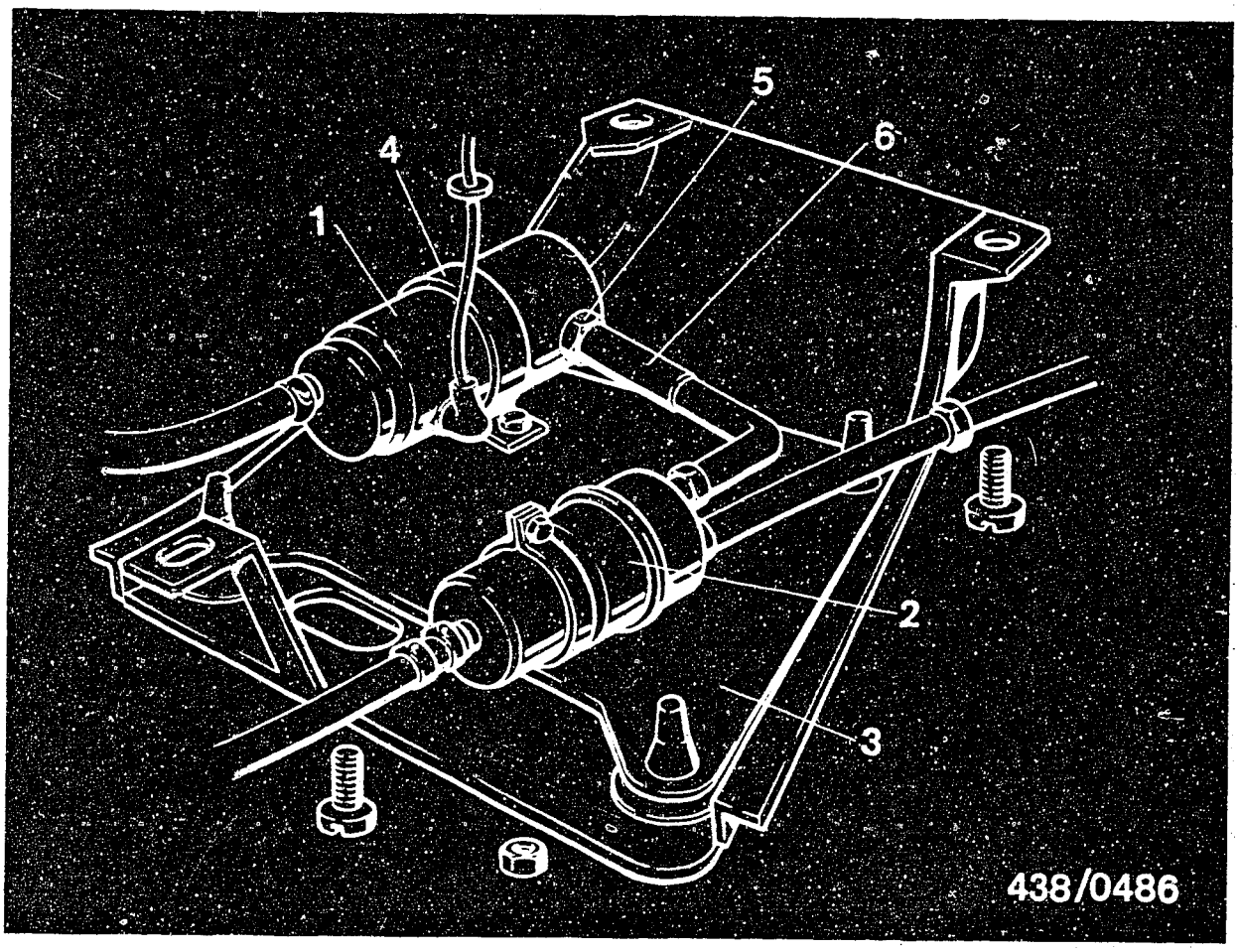


12.6 Removing and installing the electric fuel pump:

Pinch off the intake hose (1) (e.g. using hose clamper W 157 from Matra Co.) so that no fuel can escape from the fuel tank.

Loosen the hose clip and remove the intake hose from the fitting on the electric fuel pump.

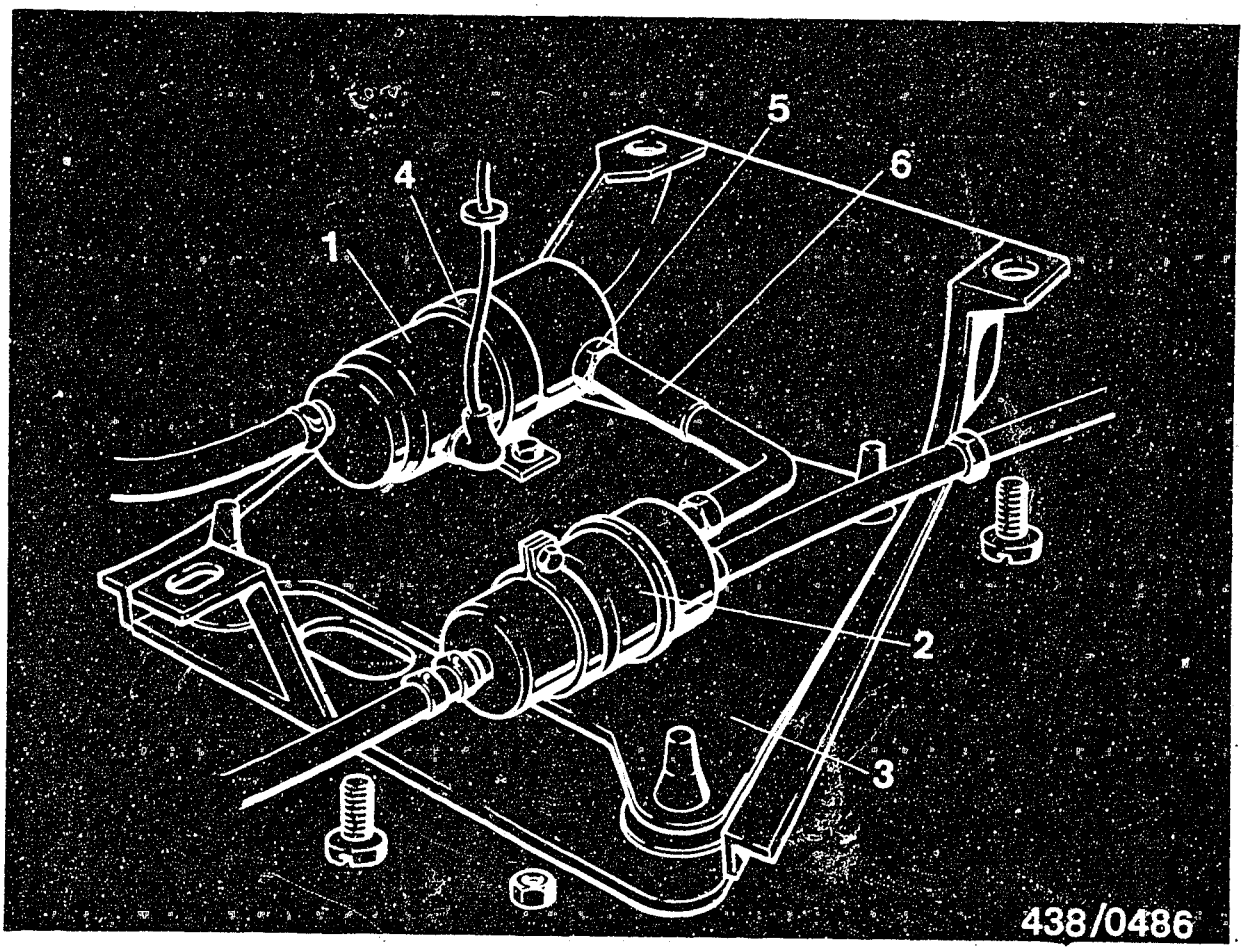
Remove the complete bracket by loosening the 3 fastening screws (2, one of the screws not visible in the picture) and hold slightly downward with the accumulator lines connected. Make sure that the lines still connected are not damaged.



1 = Electric fuel pump
2 = Fuel accumulator
3 = Bracket
4 = Clamping clip
5 = Delivery fitting with non-return valve
6 = Delivery line

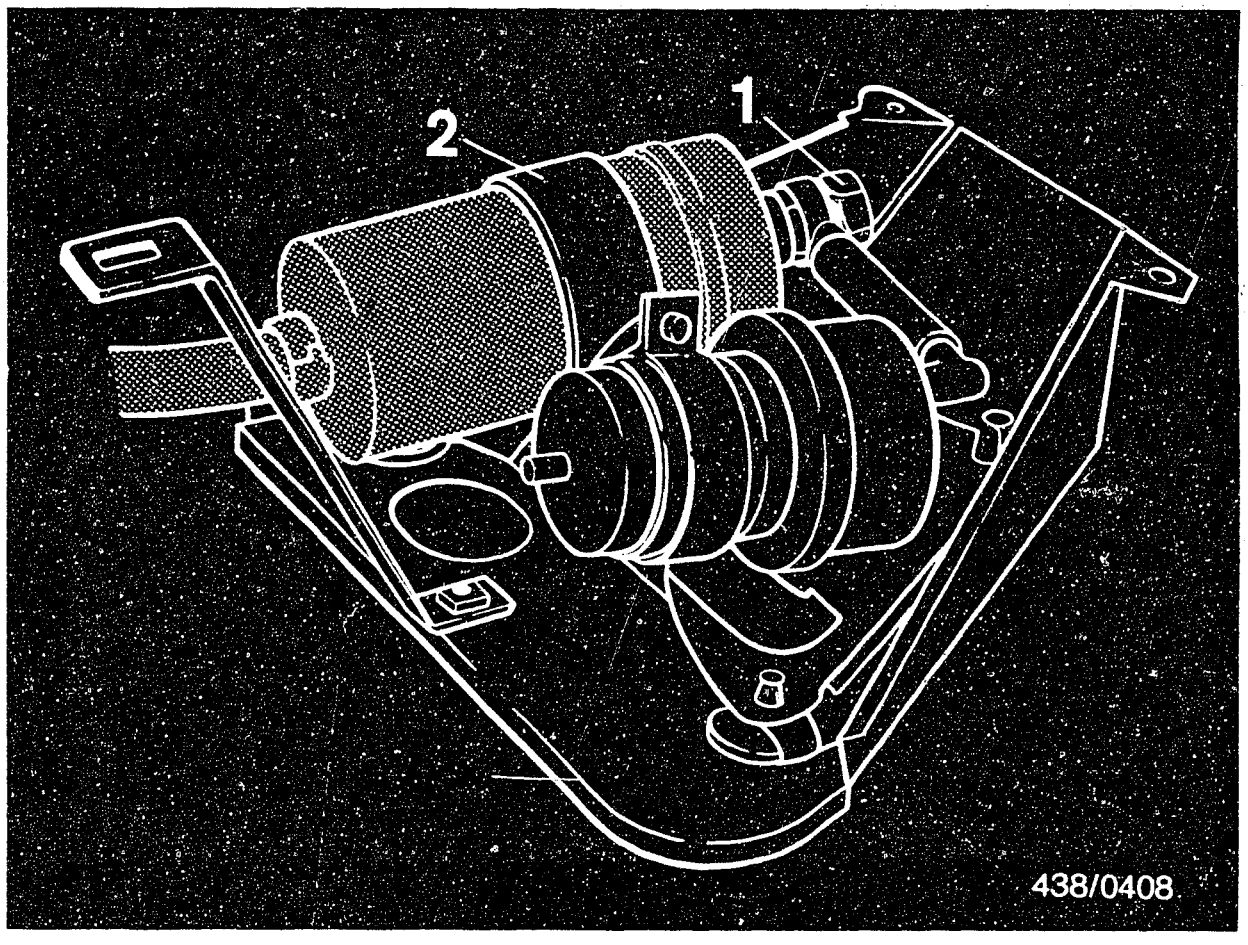
The 1978/1979 Volvo models are equipped with an electric fuel pump of Type EKP I (with lateral delivery fitting).

Removing the electric fuel pump:
Unscrew the delivery line (6) from the accumulator (2).
Unscrew the clamping clip (4) and remove the electric fuel pump.



Remove the delivery line (6) from the delivery fitting (5).

Install in the reverse order, ensuring that the delivery line (6) is in proper condition and that it is securely seated on the delivery fitting (5). If necessary, use a new delivery line (Volvo service part).
Then check all connections for leaks with the pump operating.

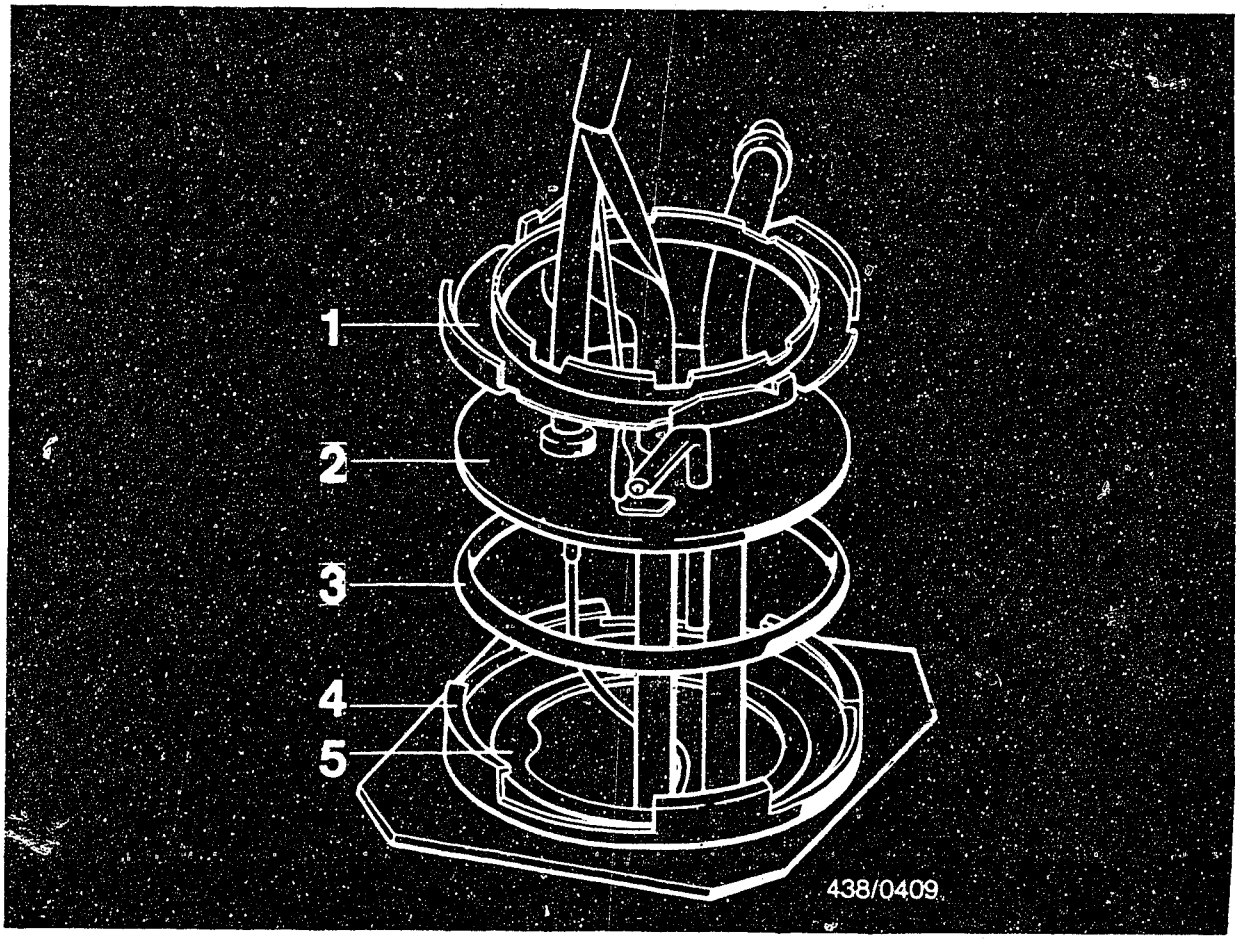


As from the 1980 model, the Volvo models are equipped with an electric fuel pump of Type EKP IV (intake and delivery fittings central in the longitudinal direction of the pump).

Unscrew the delivery line (1) from the delivery fitting of the electric fuel pump. Loosen the clamping clip (2) and remove the electric fuel pump.

Install in the reverse order, using new seal rings for the delivery line.

Finally, check all connections for leaks with the pump operating.



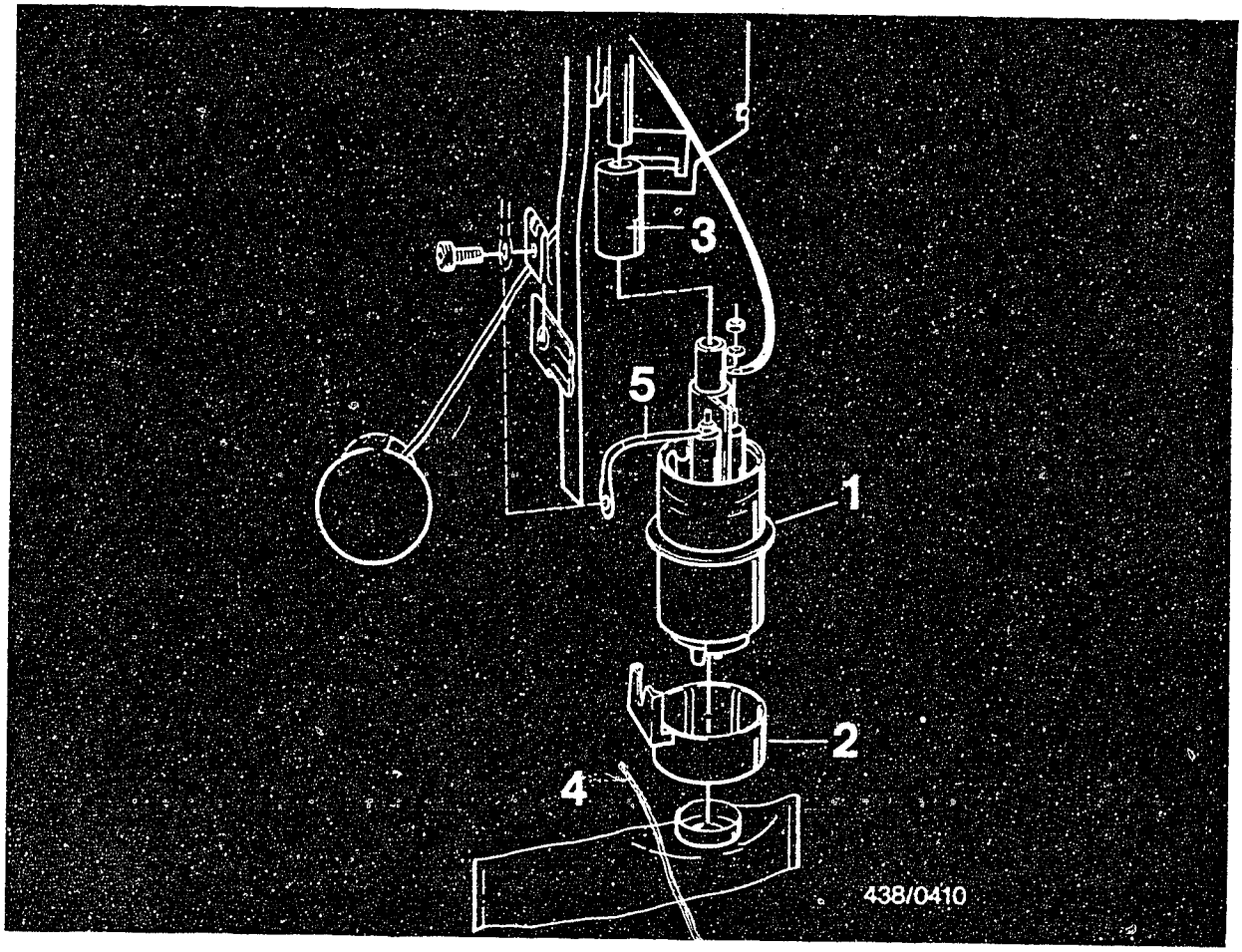
1 = Fastening ring
2 = Fastening flange
3 = Seal ring
4 = Installation opening in fuel tank
5 = Locator

12.7 Removing and installing the pre-supply pump:

The pre-supply pump is combined to form one unit together with the pickup for the fuel level indicator. The pickup becomes accessible after removing the luggage-compartment mat and the small cover fastened by 2 screws. Clean the immediate surrounding area in order to remove the pickup. Loosen the fastening ring by turning in a counterclockwise direction and carefully remove the pickup from the fuel tank.

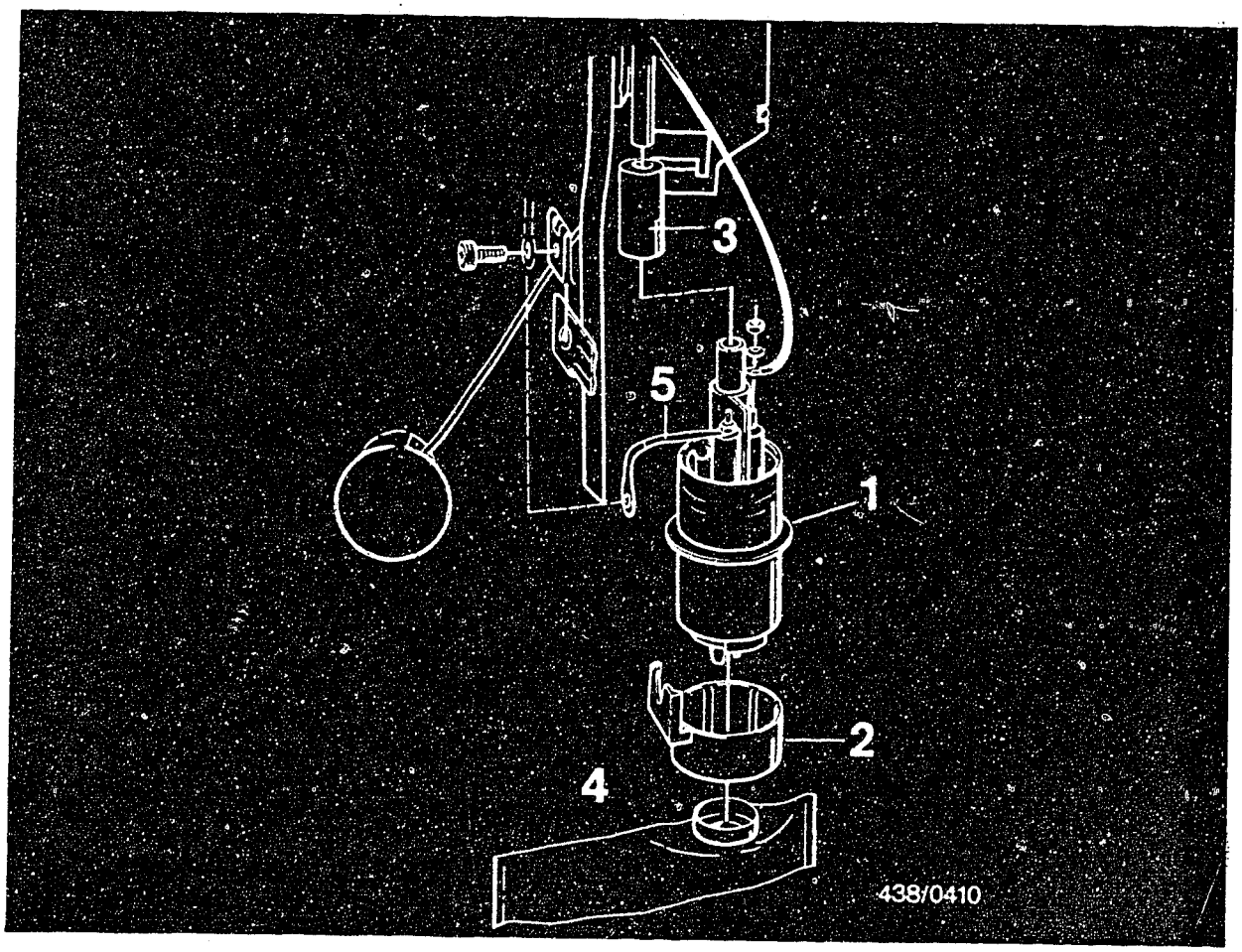
Note the following points when replacing the pre-supply pump after the pickup has been removed.

When installing, it may be necessary to use a new seal ring. Ensure the correct position of the fastening flange so that it locates in the installation opening.



So far Volvo has used two different makes of pre-supply pump, VDO and AC.

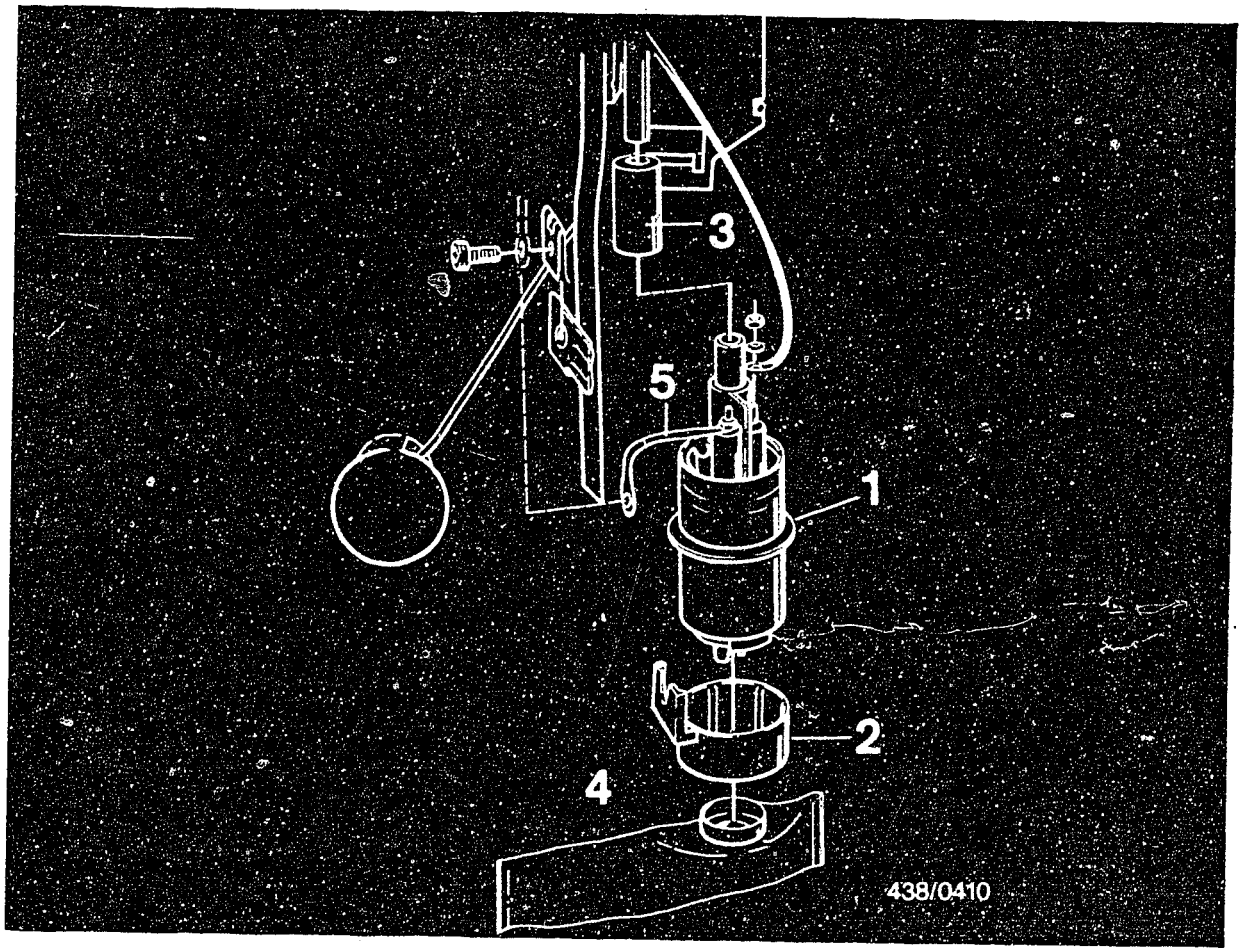
As of the end of 1980 Volvo only supplies the AC pump as a service part. If the pre-supply pump is defective, therefore, it may be necessary to replace a VDO pump with an AC pump.



The following parts are required for conversion (purchase from the Volvo agent with the pre-supply pump):

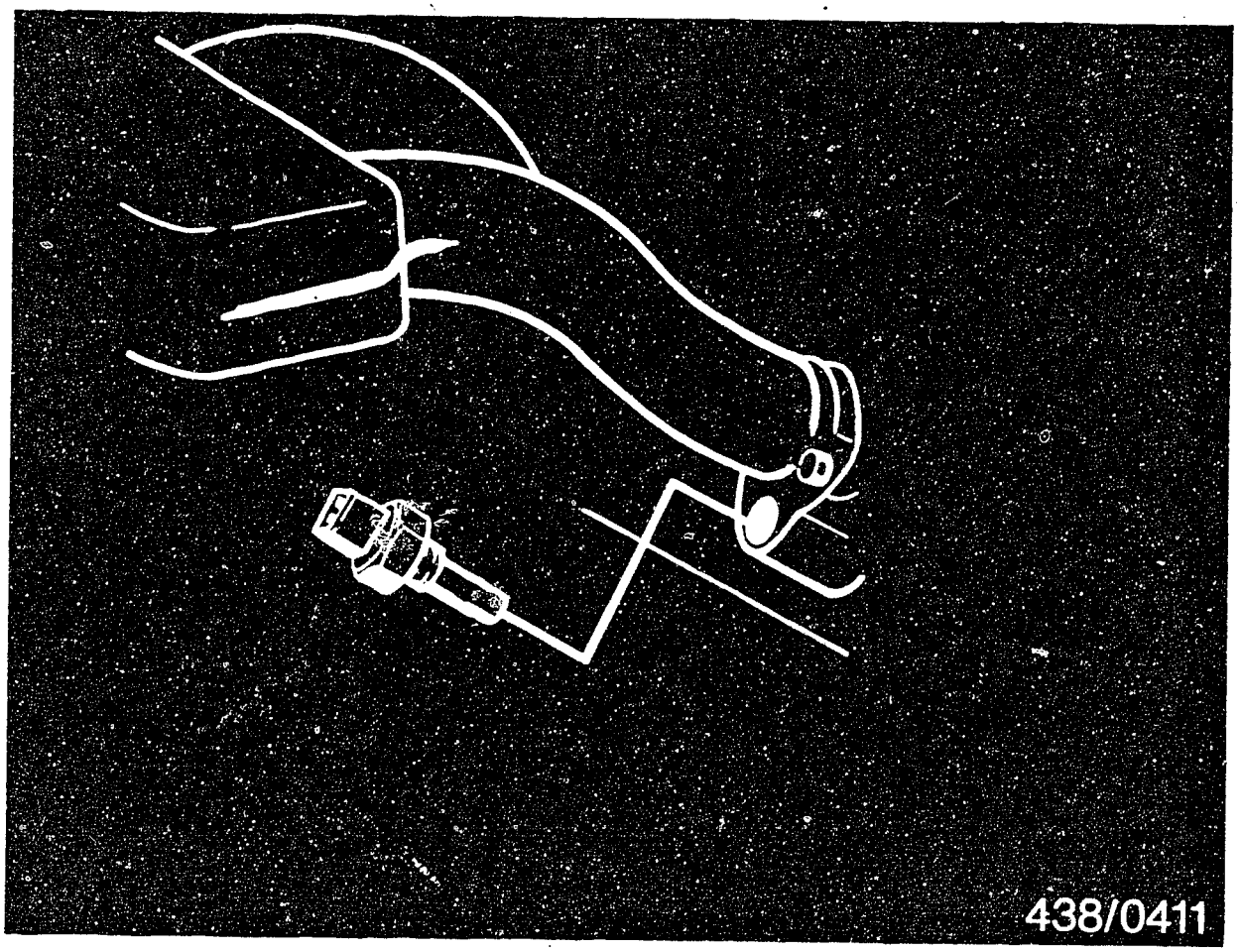
1 = Pre-supply pump
2 = Bracket
3 = Tailpiece (if required)
4 = Intake filter (if required)
5 = Ground strap

When converting, connect the ground strap directly to the negative terminal of the AC pump.



In contrast to the VDO pump, the AC pump is not interference-suppressed. Therefore, after installing the AC pump, fit an interference-suppression resistor (Volvo Part No. 1 235 204-3). This resistor is connected into the positive lead outside the fuel tank (in series).

As from the beginning of 1981, a new pickup for the fuel level indicator is available from Volvo (Volvo Part No. 1 258 853-9). This pickup is specially prepared for the AC pump and is interference-suppressed.

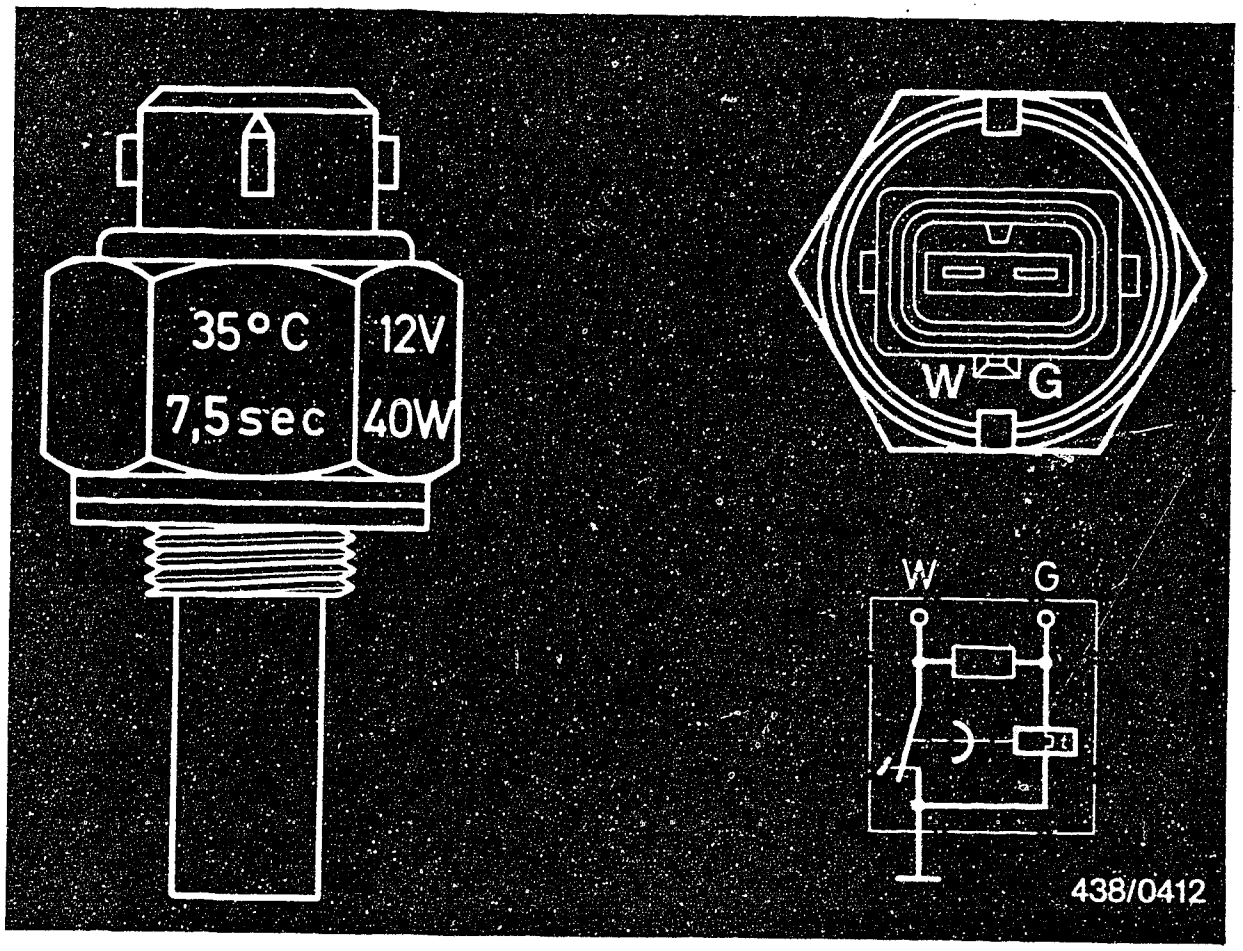


13. Testing the cold-starting system (thermo-time switch, start valve)

13.1 Thermo-time switch:

Remove the thermo-time switch for testing. It is screwed into the flange of the air-inlet port of cylinder 4 on the cylinder head.

Caution:
If possible, remove only when the engine is cold since a small amount of coolant will escape. The amount of coolant escaping would be considerably greater if the engine were hot.



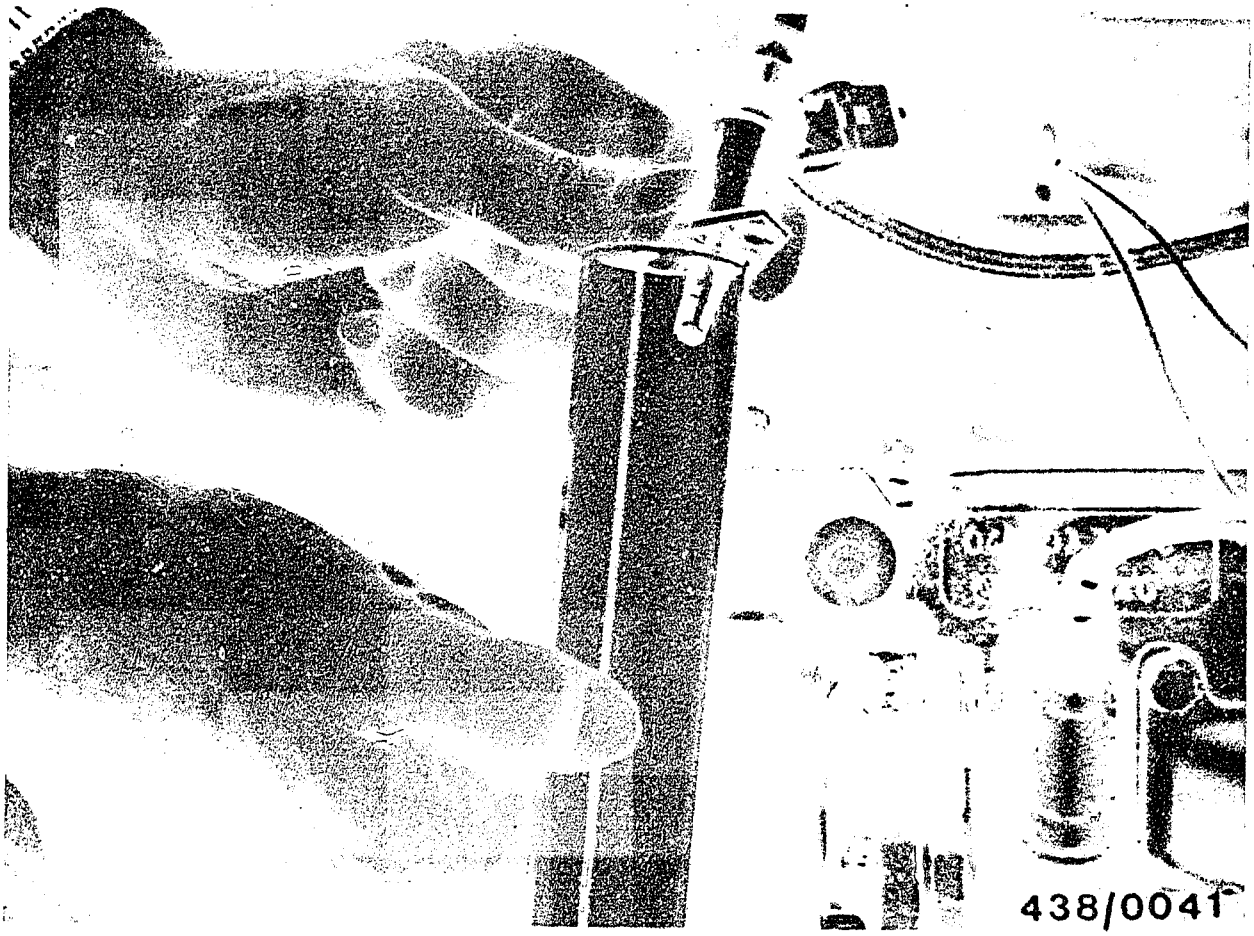
The thermo-time switch used in the Volvo (not a Bosch product) has a switching temperature of 35°C and a switching time at -20°C of 7.5 seconds. Both values are marked on the hexagonal section of the thermo-time switch.

The removed thermo-time switch is tested using an ohmmeter in accordance with the values given below.

The temperatures for the thermo-time switch can easily be obtained with water. Cooling takes place in a freezer chest.

Resistance measurement (Ω) between

At a temperature below °C	above °C	Term. "G" and "ground" (housing)	Term "W" and "ground" (housing)	Term "G" and term. "W"
+30		25...40 Ω	0 Ω	25 ... 40Ω
	+40	50...80 Ω	100...160 Ω	50 ... 80Ω



13.2 Start valve:

Remove the start valve. Hose line remains connected. Pull off the plug and connect the start valve directly to ground and to terminal 15 (e.g. at the ignition coil) using connecting cable KDJE 7450/70.

Important note:
During this test, do not let the connecting cable touch B +. Danger of fire due to sparking!
Hold the start valve in a suitable container (e.g. the graduate).

Switch on the electric fuel pump by bridging the safety circuit.
Switch on the ignition (max. 30 seconds). The start valve must now open and spray fuel.

Switch off the ignition, remove the electric connecting cable and dry the nozzle of the start valve.
The safety circuit remains bridged so that the primary pressure is applied to the start valve.
No droplets of fuel must drip from the nozzle of the start valve during the next minute. Even if shaken and knocked, the start valve must not leak.
Then switch the electric fuel pump off again.
Replace the start valve if it does not open or if it leaks.

If a leaky start valve or a defective thermo-time switch has been replaced, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.
Idle-speed adjustment is described on Coordinates F 19.

14. Checking the control pressures

14.1 Preliminary remarks:

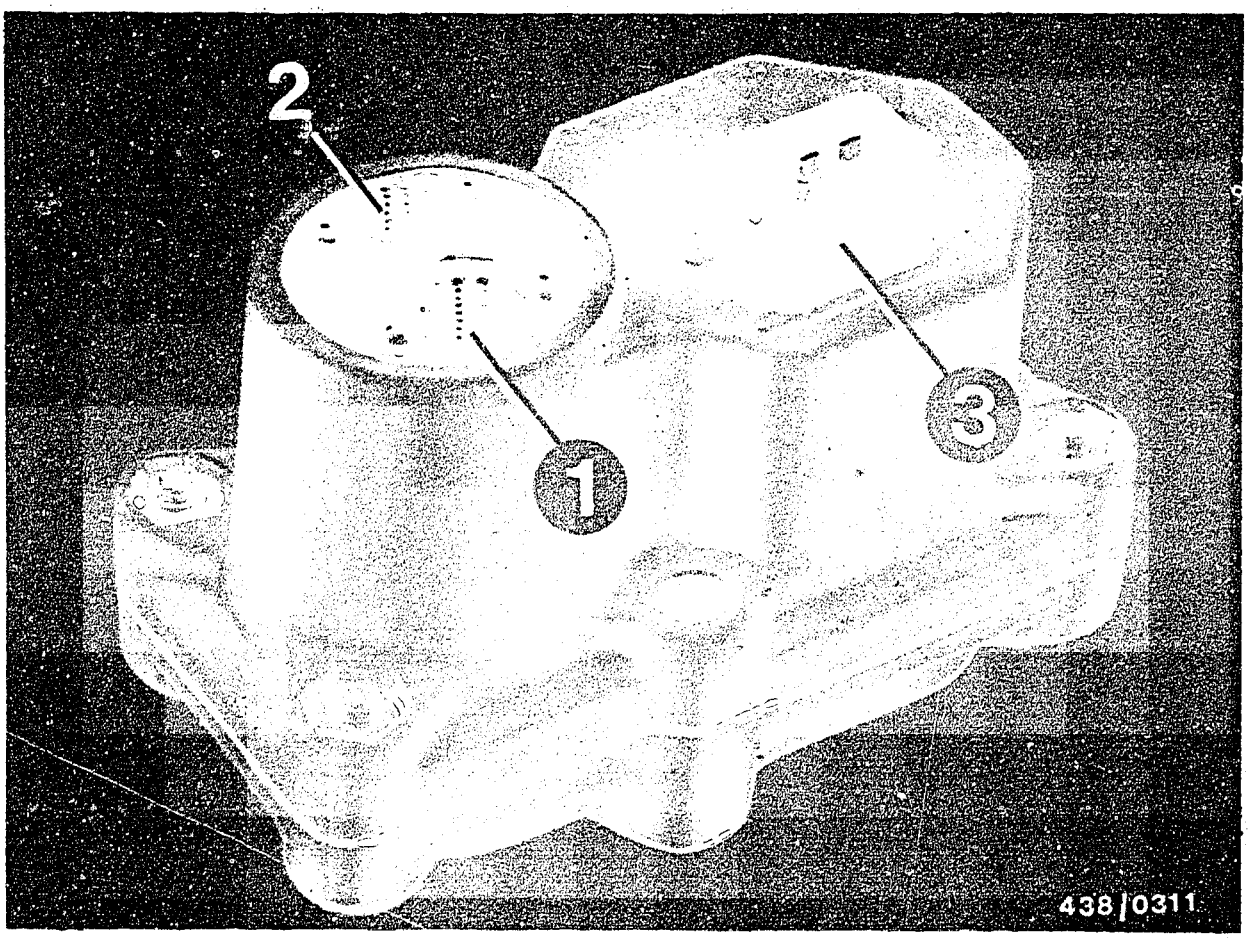
The control pressures tested in the following are in each case governed by the warm-up regulator.
If the test results are incorrect, however, this may also be due to faults which have nothing to do with the warm-up regulator.

These possible faults are:

- No or too low a voltage at the electric connector.
- Fuel return from the warm-up regulator blocked or constricted.
- Too high a fuel delivery for the control-pressure circuit.

The testing of this control-pressure delivery is described as an additional test step at the beginning of the control pressure tests.
Test specification: 160...240 cm^3/min.

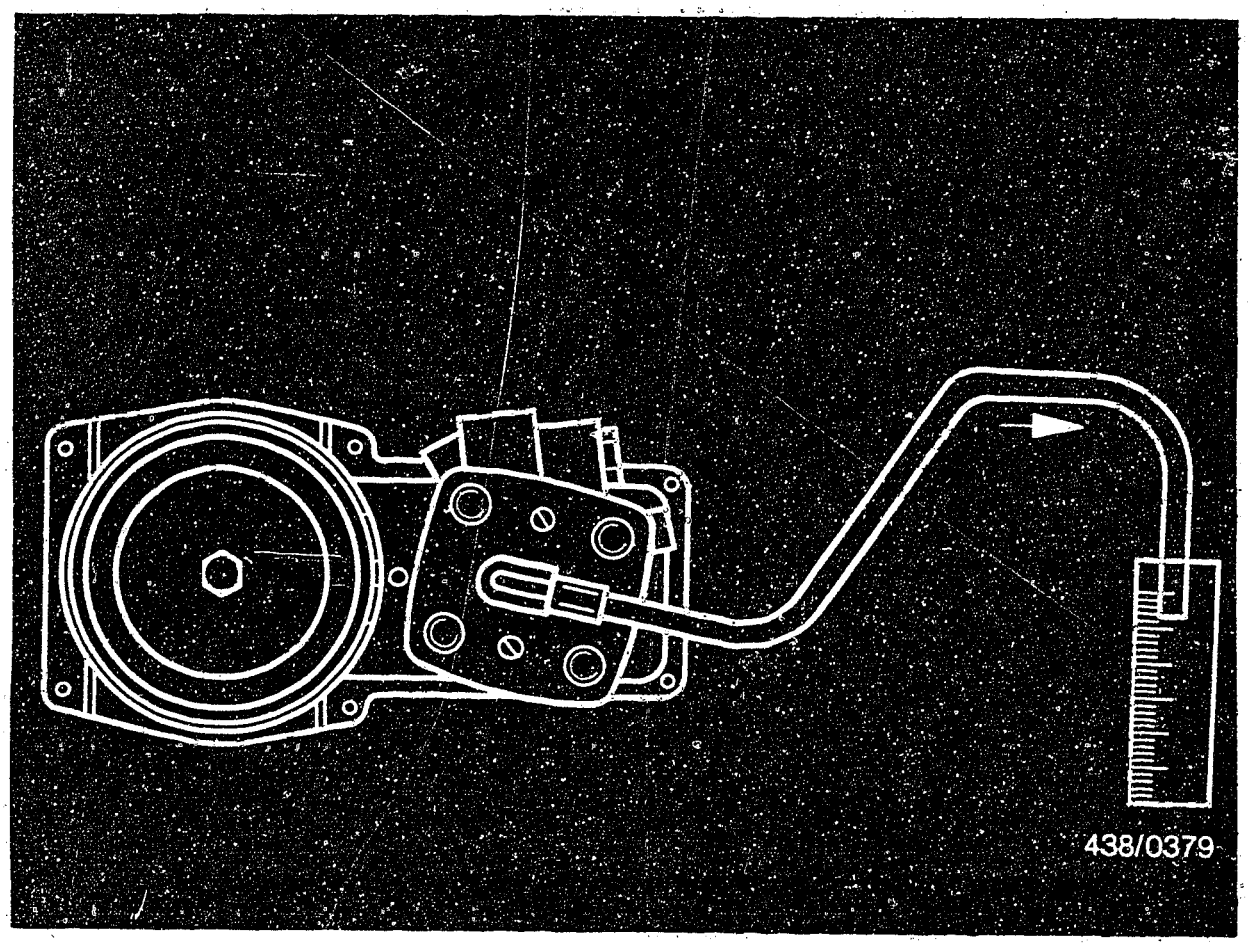
Reference is made to the other possible causes of trouble in the respective test step.



1 = Intake port (M 10 x 1)
2 = Return port (M 8 x 1)
3 = Electrical connection

14.2 Design of warm-up regulator

The warm-up regulator corresponds to the standard design, i.e. apart from control pressure "cold" and "warm" no other functions (such as full-load and altitude compensation) are performed.



14.3 Checking the fuel delivery for the control-pressure circuit:

Before testing: Make sure that the electric fuel pump is operating properly. Test specification: min. 750 cm^3/30 s.

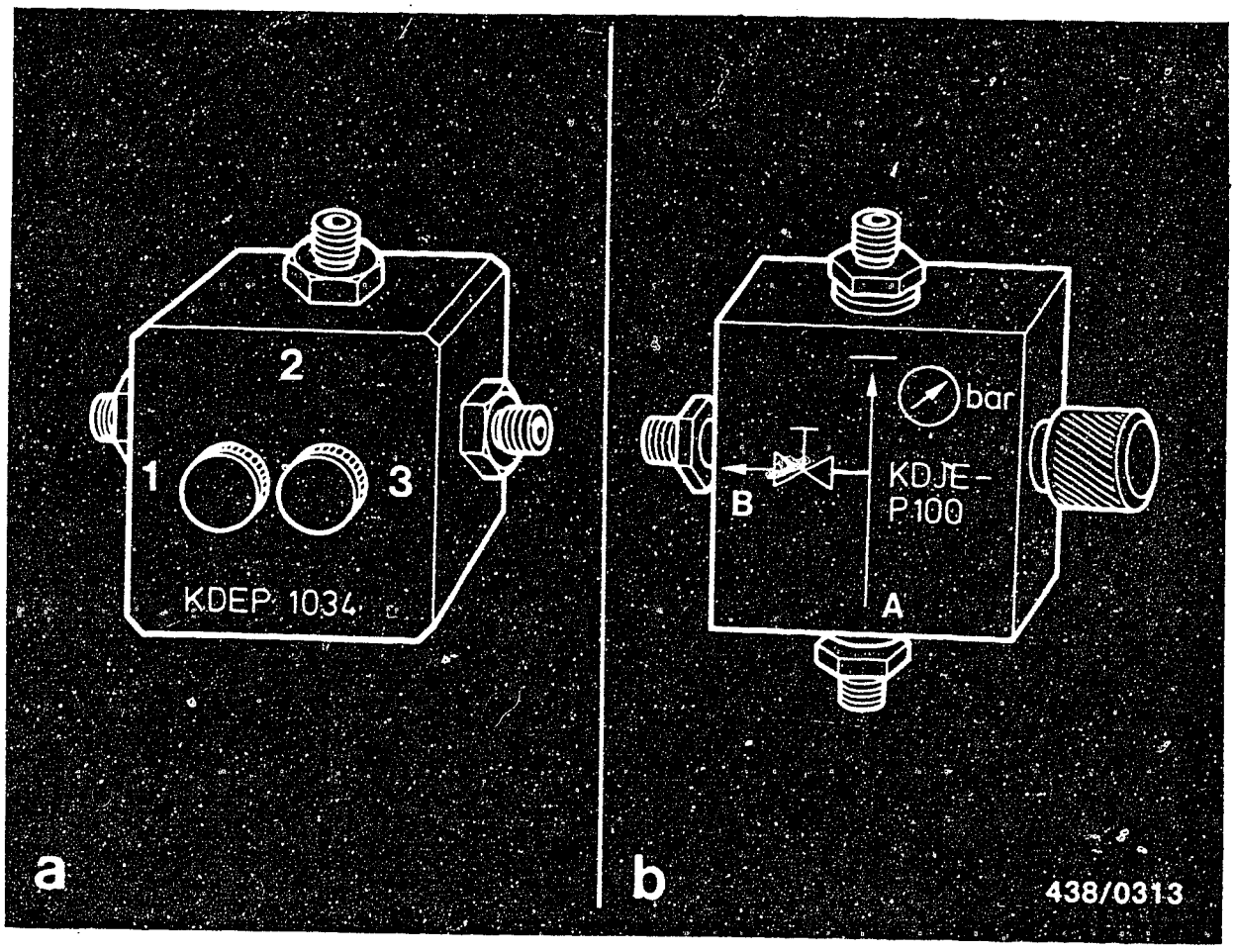
Unscrew the control-pressure line (to the warm-up regulator) from the fuel distributor.

Screw connecting piece (thread M 8 x 1/M 12 x 1.5) from connecting parts set KDJE-P 100/10 onto control-pressure port. Connect one of the two connecting hoses of the pressure tester KDJE-P 100 (previously KDEP 1034) to the connecting piece on the fuel distributor (thread M 12 x 1.5) and hold hose in graduate (approx. 0.5 litre capacity).

Switch on the electric fuel pump for 1 minute by bridging the safety circuit.
Measure delivery.

Test specification: 160...240 cm^3/min.

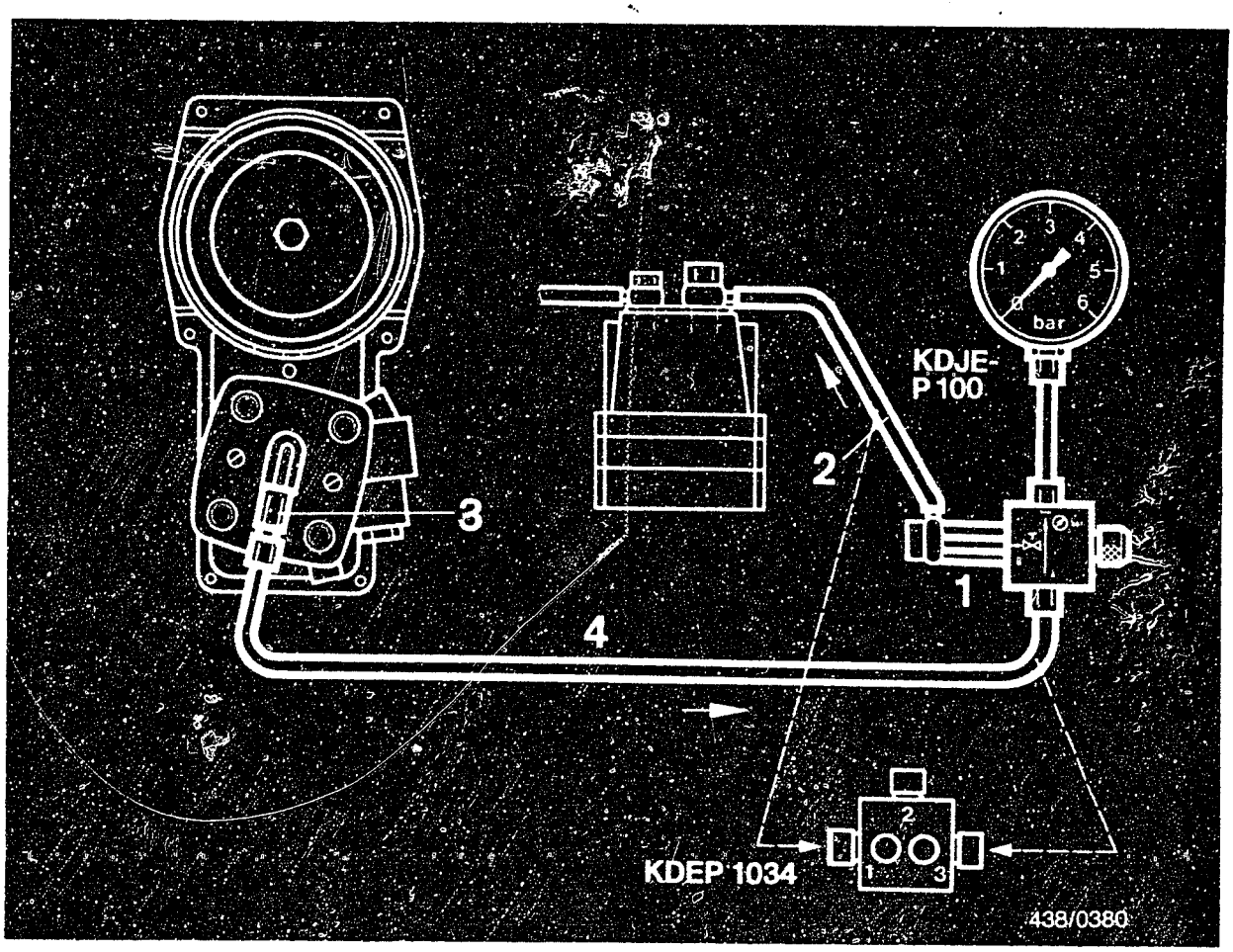
If the measured value is outside tolerance, the fault is in the fuel distributor.
Replace the fuel distributor.



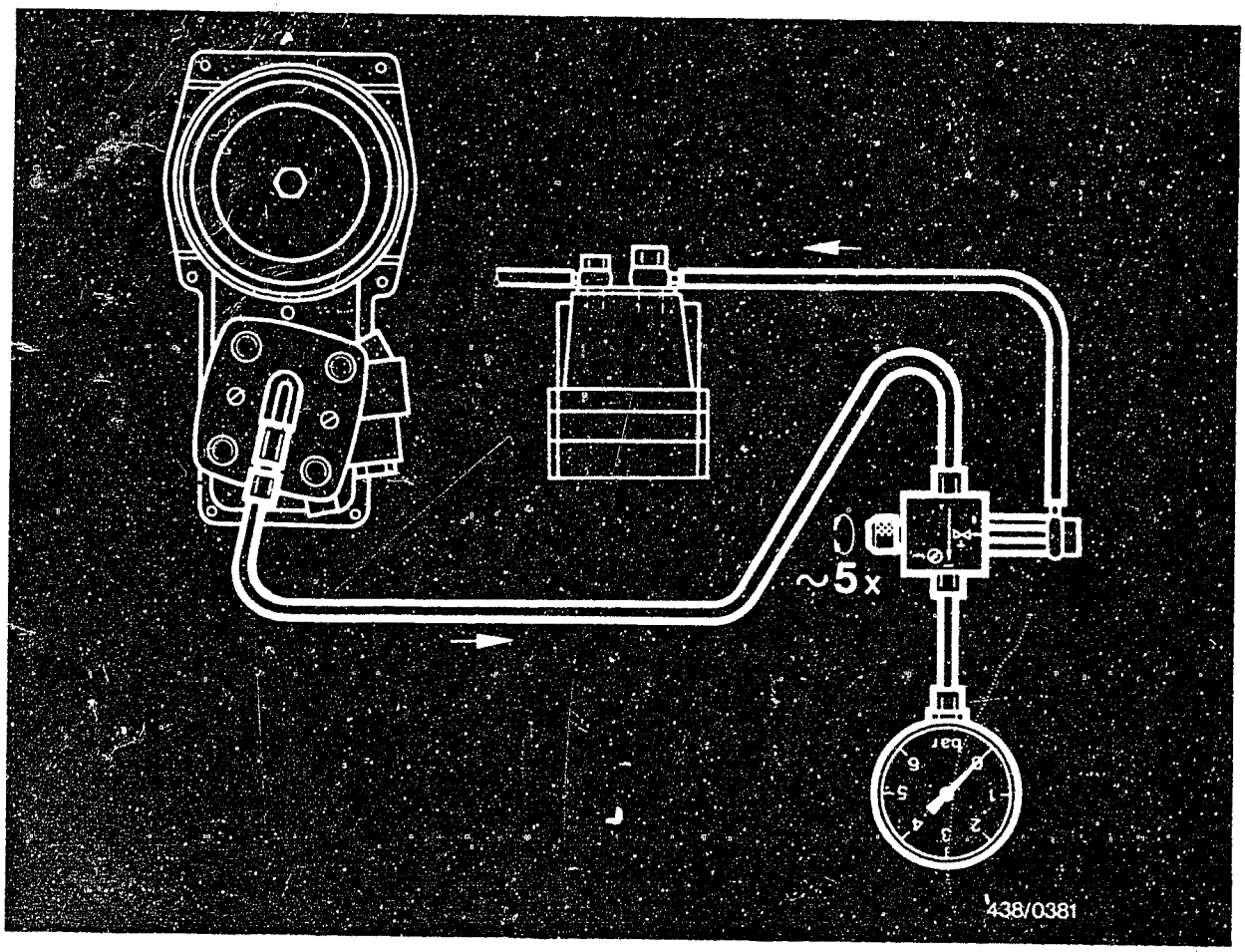
14.4 Mounting the pressure tester KDJE-P 100 (formerly KDEP 1034):

The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a). Since the end of 1979 the pressure tester KDJE-P 100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional-control valve are identified by symbols:
A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)

Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.



The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.
Install using connecting-parts set KDJE-P 100/10 (previously KDEP 1034/10).
Screw the adapter (1) with seal ring onto the outlet fitting B or 1 of the directional-control valve.
Unscrew the control-pressure line (2) from the fuel distributor and connect to the adapter with inlet-union screw M 8x1 and seal rings.
Screw the connecting piece (3) of the connecting-parts set into the control-pressure connection port of the fuel distributor and connect to inlet fitting A or 3 of the directional-control valve via hose line (4).
Suspend the pressure gauge from the engine-compartment lid (possibly using a wire hook).



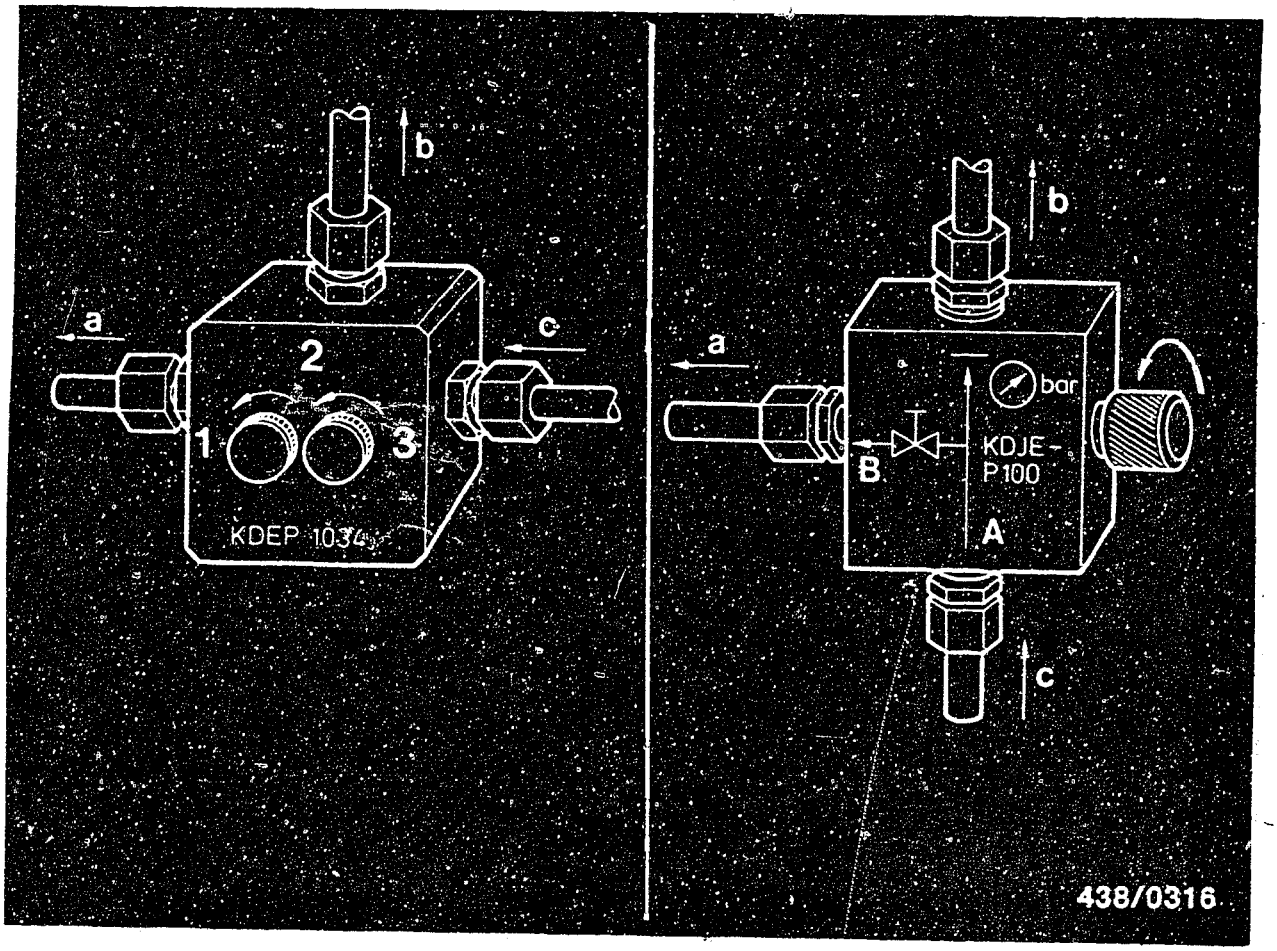
14.5 Bleeding the pressure tester

Disconnect the electric plug from the warm-up regulator. Let the pressure gauge hang down (hose fully extended).

Switch on the electric fuel pump by bridging the electrical safety circuit.

Open and close the valve screw(s) of the directional-control valve in a 10-second rhythm about 5 times.

Then hang the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood). Open valve screw of directional-control valve (both screws in the case of KDEP 1034) (turning to the left).

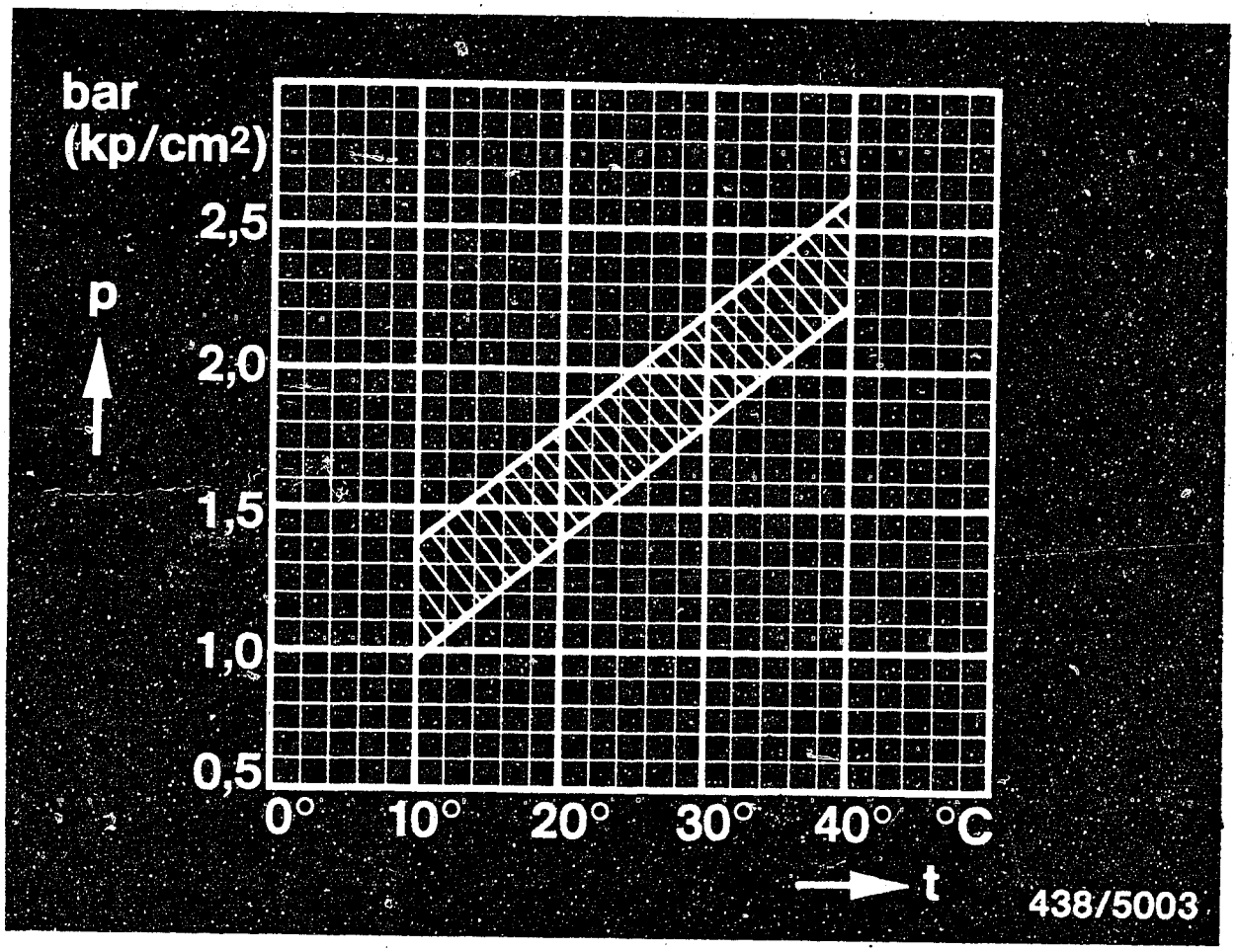


a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

14.6 Testing the "cold" control pressure:

Warm-up regulator: 0 438 140 004

The test is performed with the engine switched off. The engine must be cold. For this purpose, the engine should have been switched off for several hours, preferably overnight.
Pull off the plug from the warm-up regulator.
Open the valve screw of the directional-control valve (both screws in the case of KDEP 1034).
Switch on the electric fuel pump by bridging the electrical safety circuit.



p = Control pressure (bar or kgf/cm^2 gauge pressure)
t = Ambient temperature (^{o}C)

Warm-up regulator Part No.: 0 438 140 004

Calculate the nominal control pressure in accordance with the ambient temperatures in the graph.

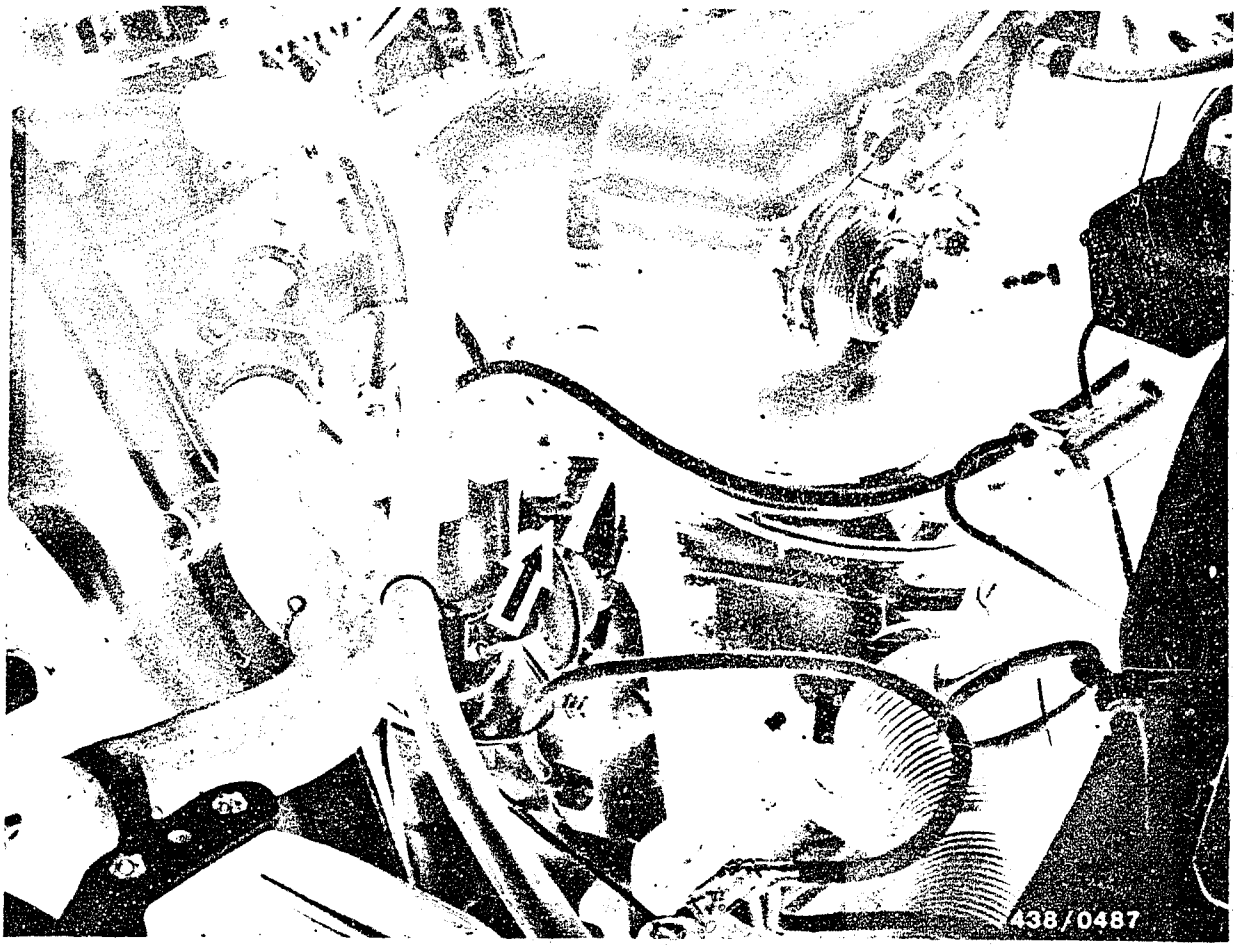
Example: Ambient temperature = 20^{o}C
Nominal control pressure = $\frac{\text{1.4...1.8 bar}}{\text{gauge pressure}}$

If the measured "cold" control pressure differs from the nominal value, this may be due to one of the following faults:

- Fuel delivery for the control-pressure circuit too low or too high.
 Test fuel delivery.
 Test value: 160...240 cm^3/min.

- Fuel return from the warm-up regulator blocked or constricted (if control pressure too high).
 Eliminate constriction.

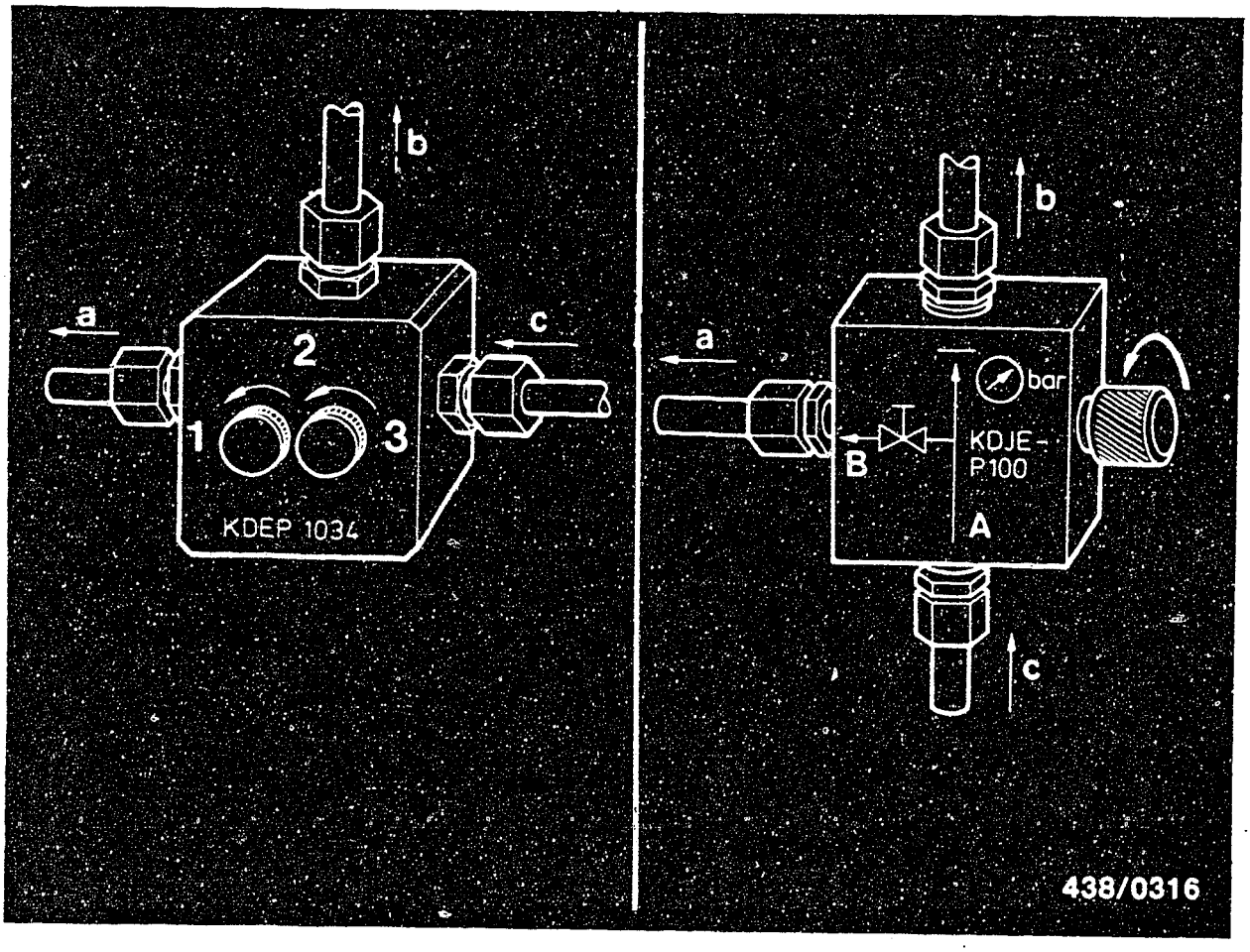
- Warm-up regulator defective. Replace warm-up regulator.



14.7 Removing and installing the warm-up regulator:

The removal and installation of the warm-up regulator (arrow) poses no problems.

When connecting the fuel lines, use new seal rings.



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

14.8 Testing the "warm" control pressure:

Warm-up regulator Part No.: 0 438 140 004

The test is performed with the engine switched off.
The temperature of the engine is not important.

Open the valve screw of the directional-control valve (both screws in the case of KDEP 1034).

Switch on the electric fuel pump by bridging the electrical safety circuit.

Attach the plug to the warm-up regulator.

Control pressure now rises (the warm-up regulator in the process of shutting off) until the "warm" control pressure is reached.

Test specifications for "warm" control pressure:	3.4...3.8 bar gauge pressure (3.5...3.9 kgf/cm³ gauge pressure)

If the measured "warm" control pressure differs from the test specification, this may be due to one of the following faults:

If control pressure too high:

- Fuel delivery for the control-pressure circuit too high.
 Test fuel delivery.
 Test specification: 160...240 cm^3/min.
- Fuel return from the warm-up regulator blocked or constricted. Eliminate constriction.
- Warm-up regulator has hydraulic defect.
 Replace warm-up regulator.

If control pressure too low:

- Power supply open-circuit.
 Eliminate open circuit. Ensure that the plug is contacting properly.

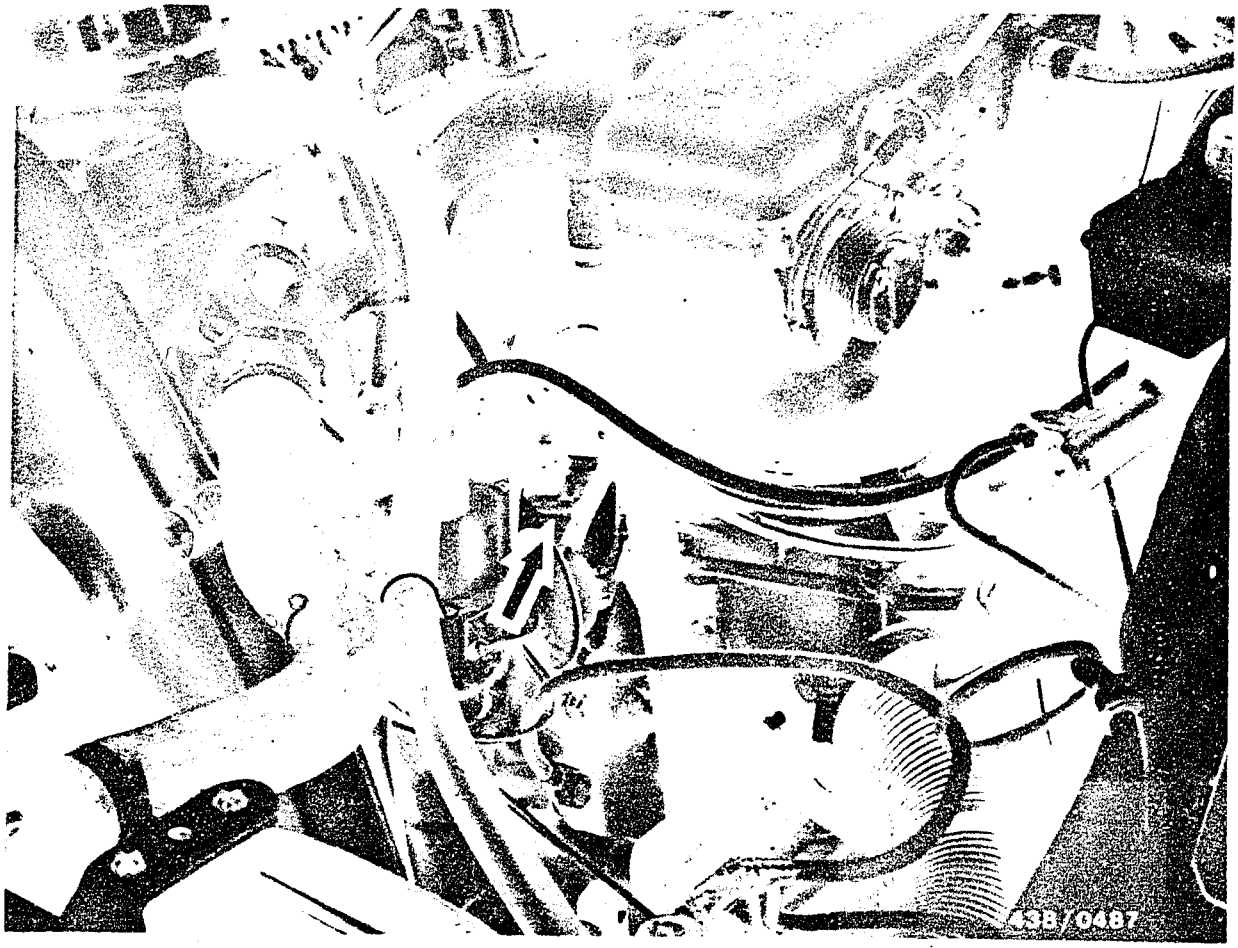
- Battery voltage too low, voltage drop.
 Eliminate voltage drop. Minimum voltage at connector: 11.5 V.
 If necessary, repeat test with engine running in order to obtain the normal generator voltage of approx. 14 V when the vehicle is in operation.

- Fuel delivery for the control-pressure circuit too low.
 Test fuel delivery.
 Test specification: 160...240 cm^3/min.

- Warm-up regulator defective. Heating coil open-circuit. Hydraulic defect. Replace warm-up regulator.

When the warm-up regulator has been replaced, or when a defect has been remedied, the idle speed is to be set finally with the engine at normal operating temperature.

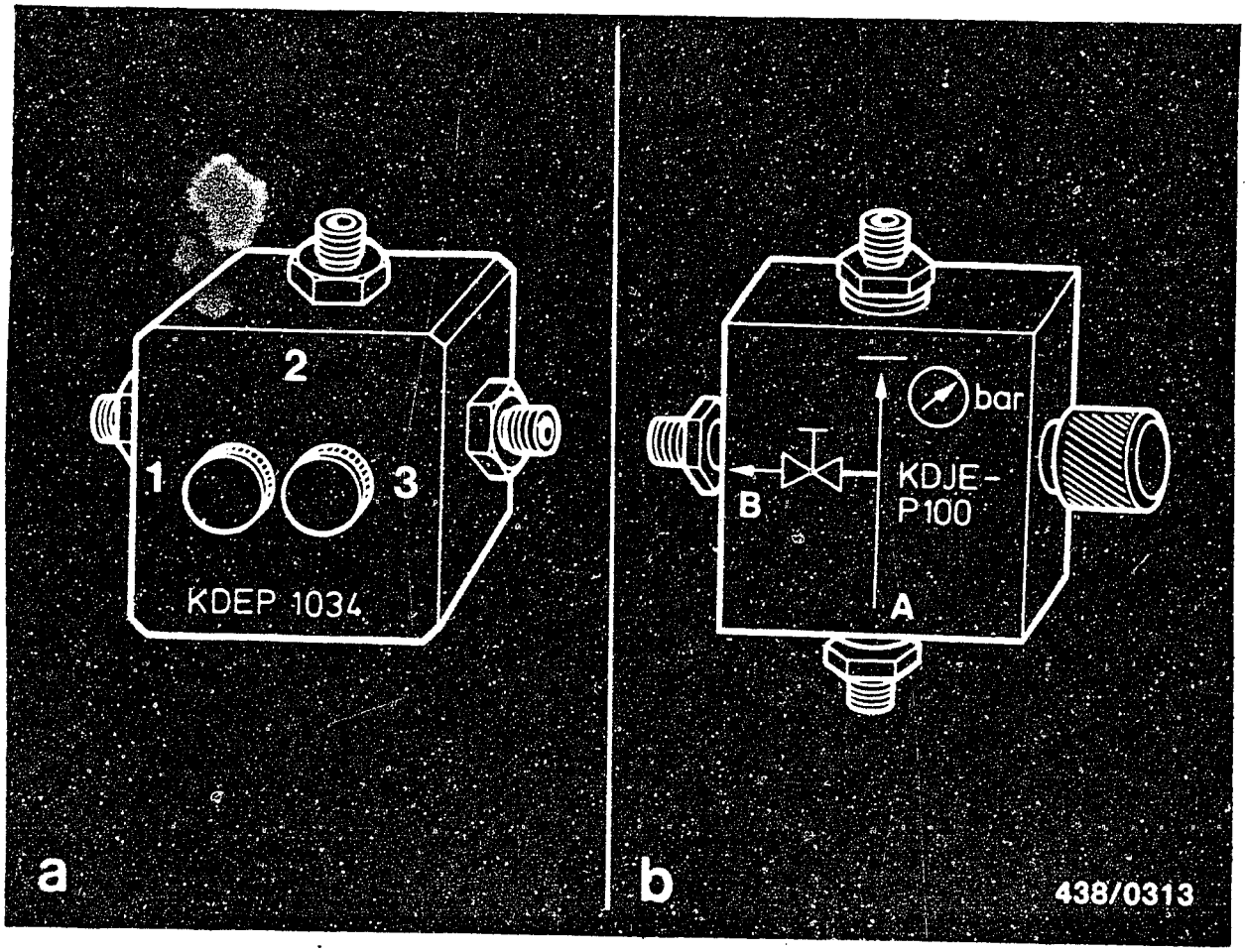
Idle-speed adjustment is described on Coordinates F 19.



14.9 Removing and installing the warm-up regulator:

The removal and installation of the warm-up regulator (arrow) poses no problems.

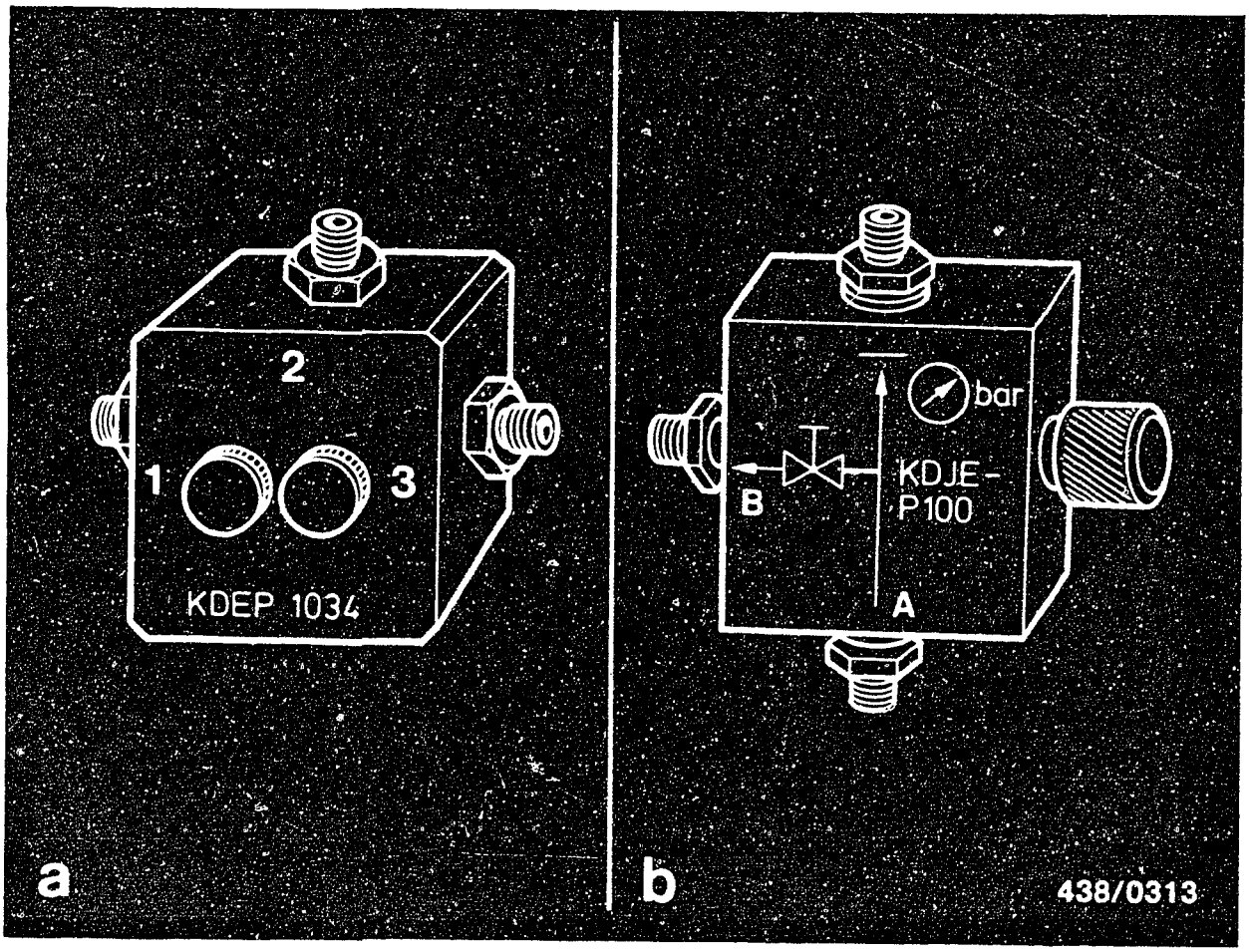
When connecting the fuel lines, use new seal rings.



15. Testing and adjusting the primary (system) pressure:

15.1 Mounting the pressure tester KDJE-P 100 (formerly KDEP 1034):

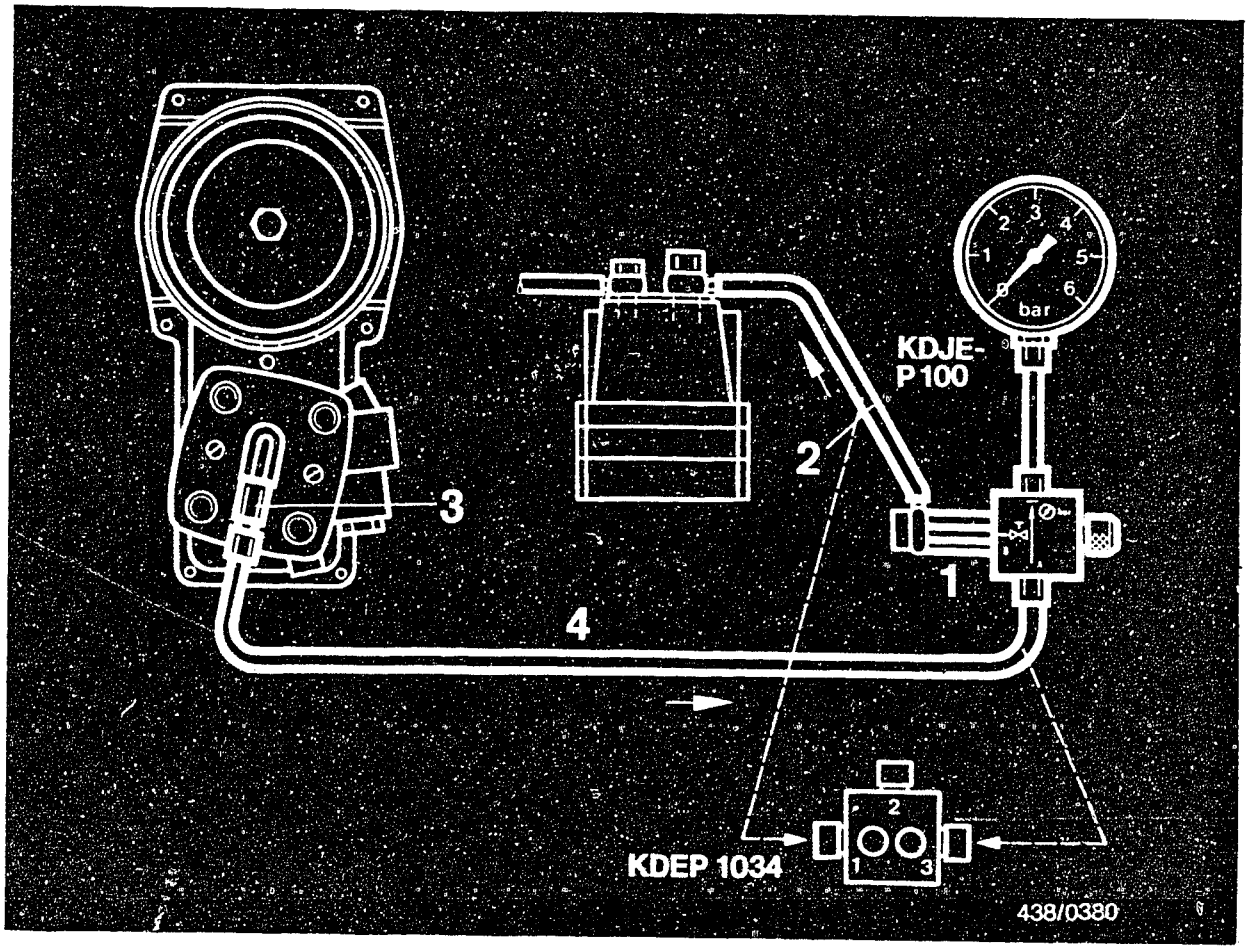
The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a).



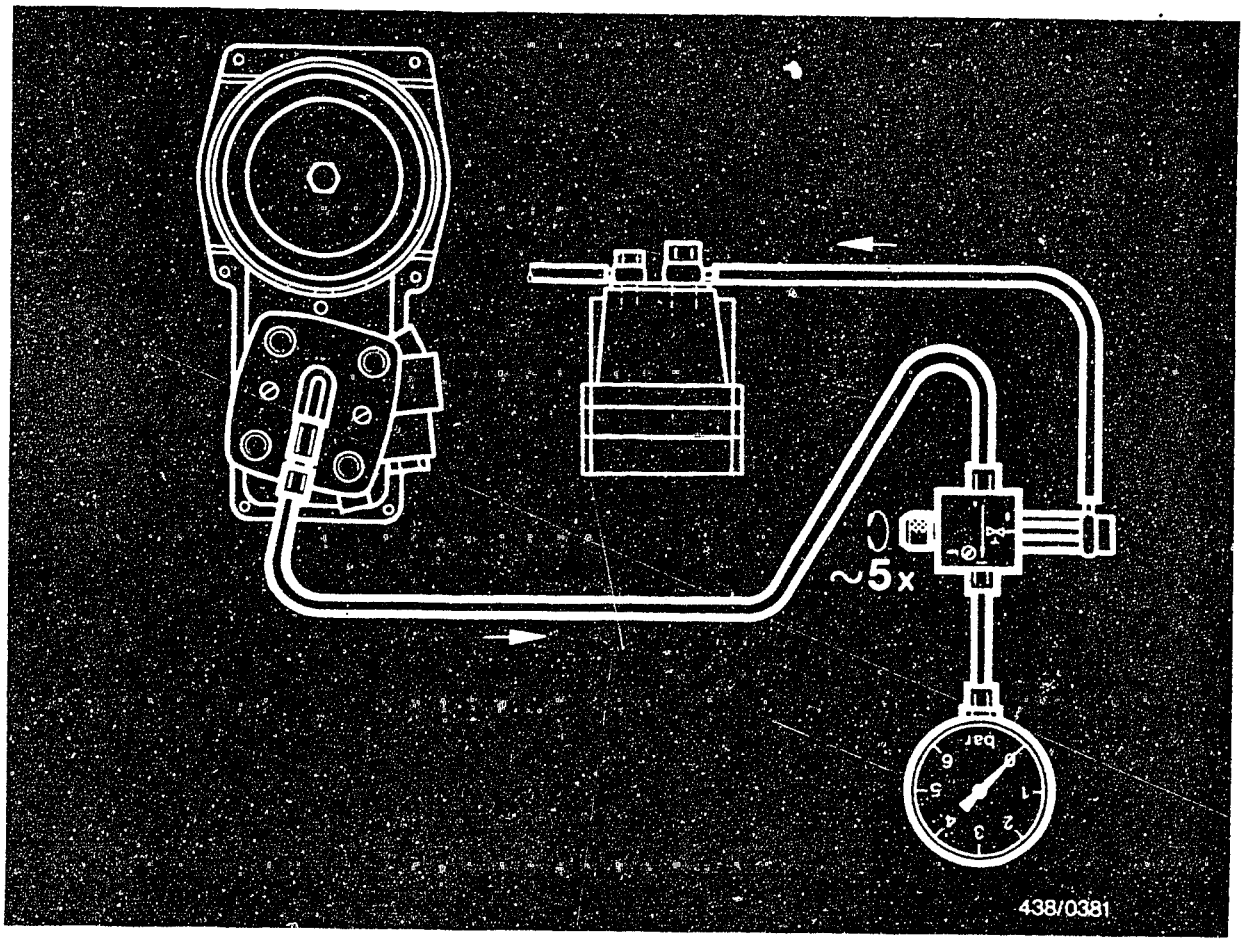
Since the end of 1979 the pressure tester KDJE-P 100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional-control valve are identified by symbols:

A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)

Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.



The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.
The connecting-parts set KDJE-P 100/10 (previously KDEP 1034/10) is additionally required.
Screw the adapter (1) with seal ring to connection port B or 1 of the directional-control valve.
Unscrew the control-pressure line (2) from the fuel distributor and connect to the adapter by means of hollow screw M 8 x 1 and seal rings.
Screw connecting piece (3) of the connecting-parts set onto control-pressure connection port of the fuel distributor and connect with connection port A or 3 of the directional-control valve via connecting hose (4).
Then hang the pressure gauge from the engine hood (perhaps with a wire hook).



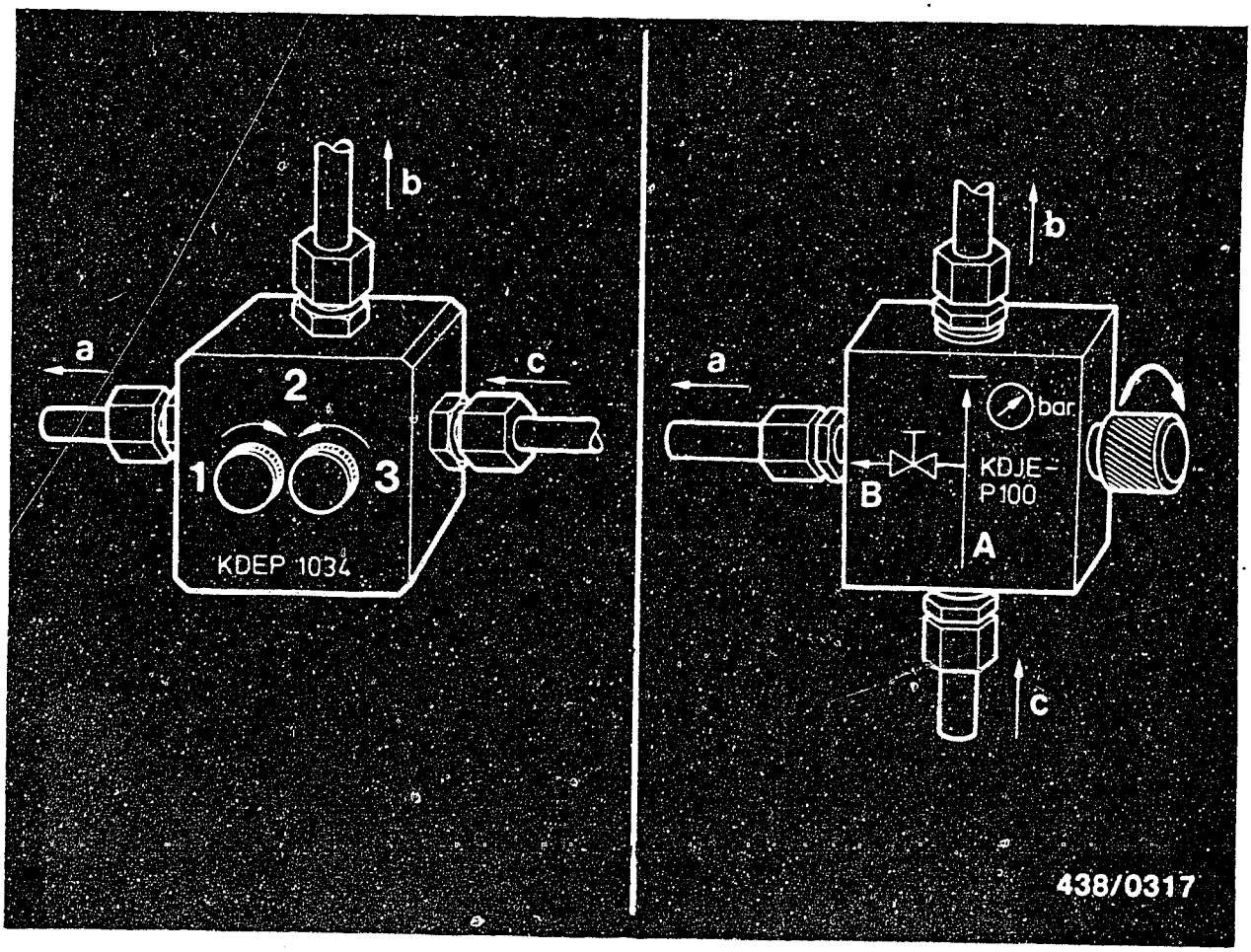
15.2 Bleeding the pressure tester

Disconnect the electric plug from the warm-up regulator. Let the pressure gauge hang down (hose fully extended).

Switch on the electrical fuel pump by bridging the electrical safety circuit.

Open and close the valve screw(s) of the directional-control valve in a 10-second rhythm about 5 times.

Then hang the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood). Open valve screw of directional-control valve (both screws in the case of KDEP 1034) (turning to the left).



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

15.3 Testing the primary pressure:

The test is performed with the engine switched off. The temperature of the engine is not important.

Close the valve screw of directional-control valve KDJE-P 100. In the case of KDEP 1034, close valve screw 1, open valve screw 3.

Switch on the electric fuel pump by bridging the electrical safety circuit.

The pressure gauge now indicates the primary pressure.

Fuel distributor Part No.	Test specifications - primary pressure (gauge pressure)
0 438 100 023) 0 438 100 074)	4.5...5.2 bar (4.6...5.3 kgf/cm^2)

Possible causes for too low a primary pressure:

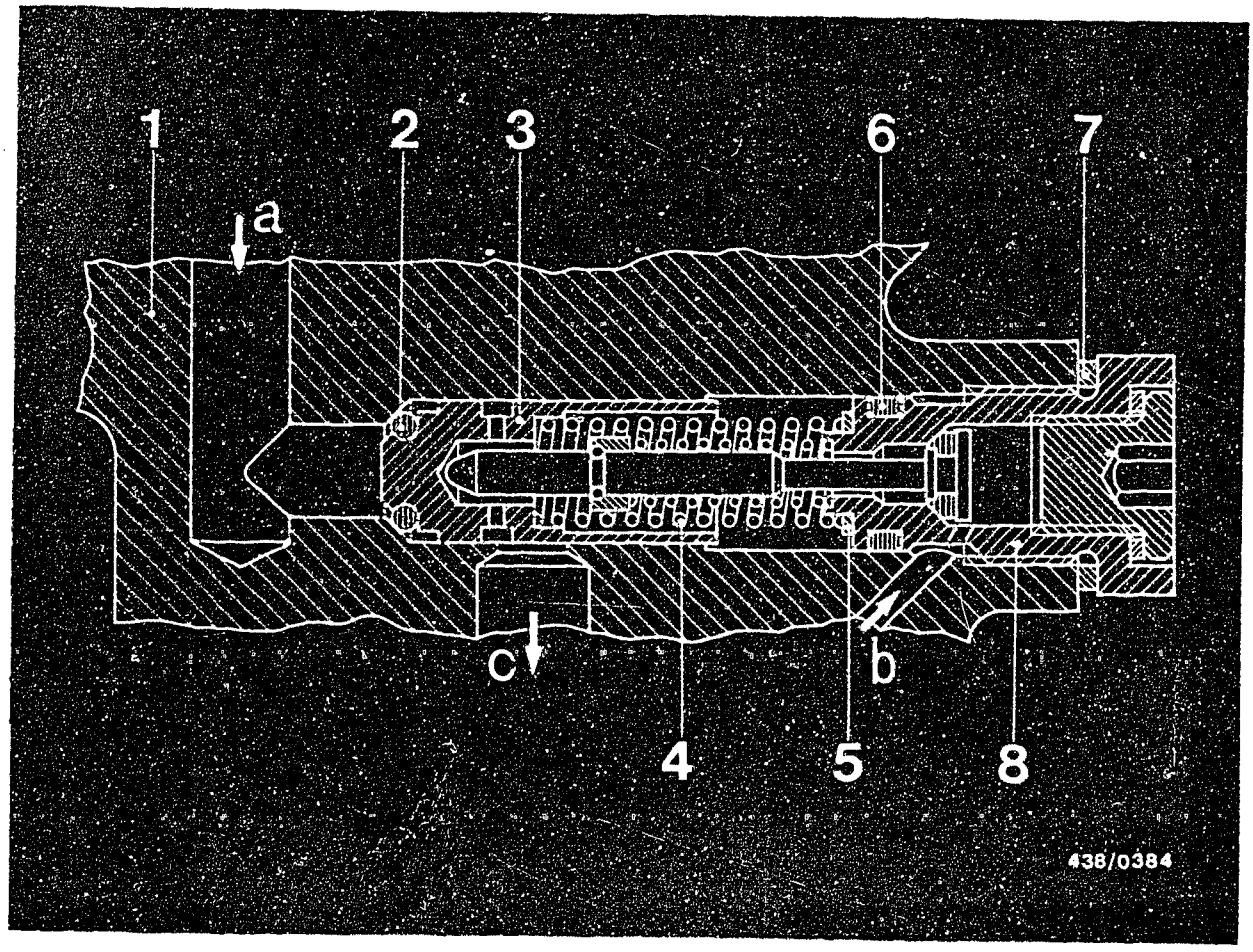
- Fuel supply faulty.
 (Delivery of electric fuel pump too low).

- Primary pressure set incorrectly.
 A precondition for readjustment of the primary pressure is always that the fuel supply is in order. Measure the fuel delivery. Test specification: 750 cm^3/30 s.

Possible causes for too high a primary pressure:

- A restriction in the return line leading to the fuel tank.

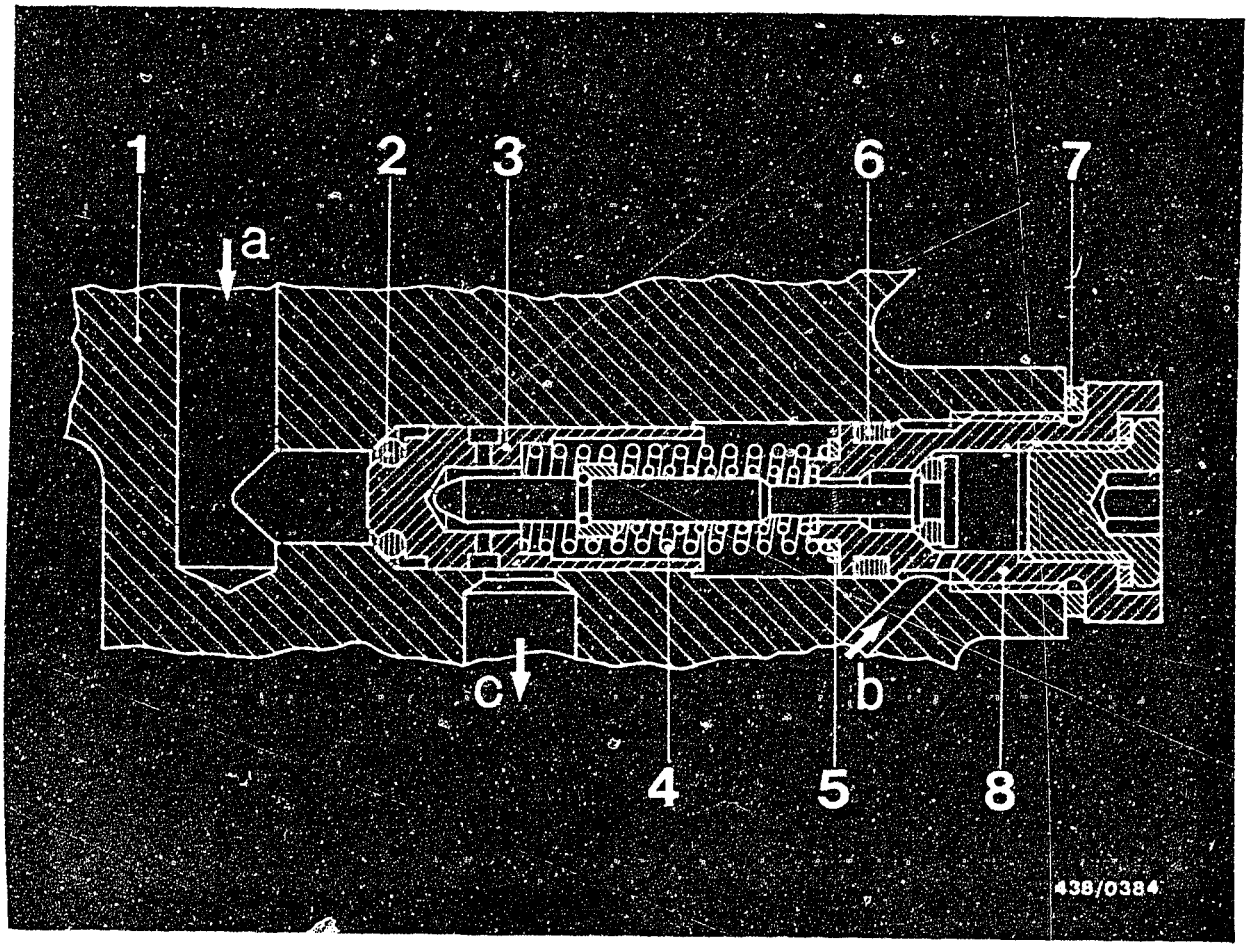
- Primary-pressure regulator set incorrectly.
 A precondition for readjustment of the primary pressure is always that the fuel supply is in order. Measure the fuel delivery. Test specification: 750 cm^3/30 s.



a = Primary pressure
b = From warm-up regulator
c = Fuel return
1 = Fuel-distributor housing
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = O-ring
7 = Flat seal ring
8 = Screw plug

15.4 Adjusting the primary pressure:

Fuel distributor Part No.	Adjustment values - primary pressure (gauge pressure)
0 438 100 023) 0 438 100 074)	4.7...4.9 bar (4.8...5.0 kgf/cm^2)

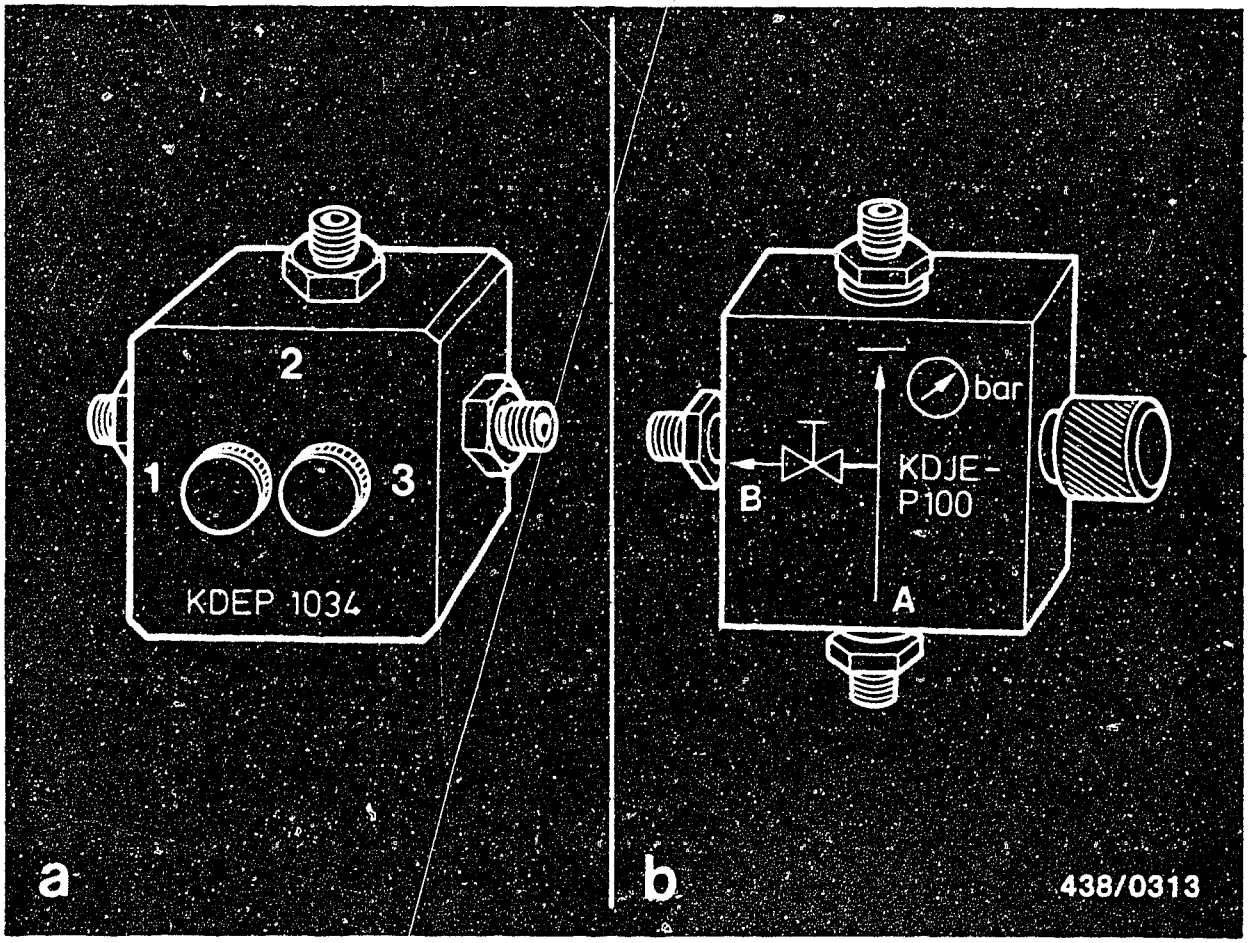


The primary pressure is readjusted by replacing the shims (Item 5).

Note:
0.1 mm more of shim thickness means about 0.15 bar pressure increase and vice versa.

To do this, screw out the large screw plug (Item 8) together with the push valve. After carrying out the adjustment, always fit the screw plug with a new flat seal ring (Item 7) and O-ring (Item 6).

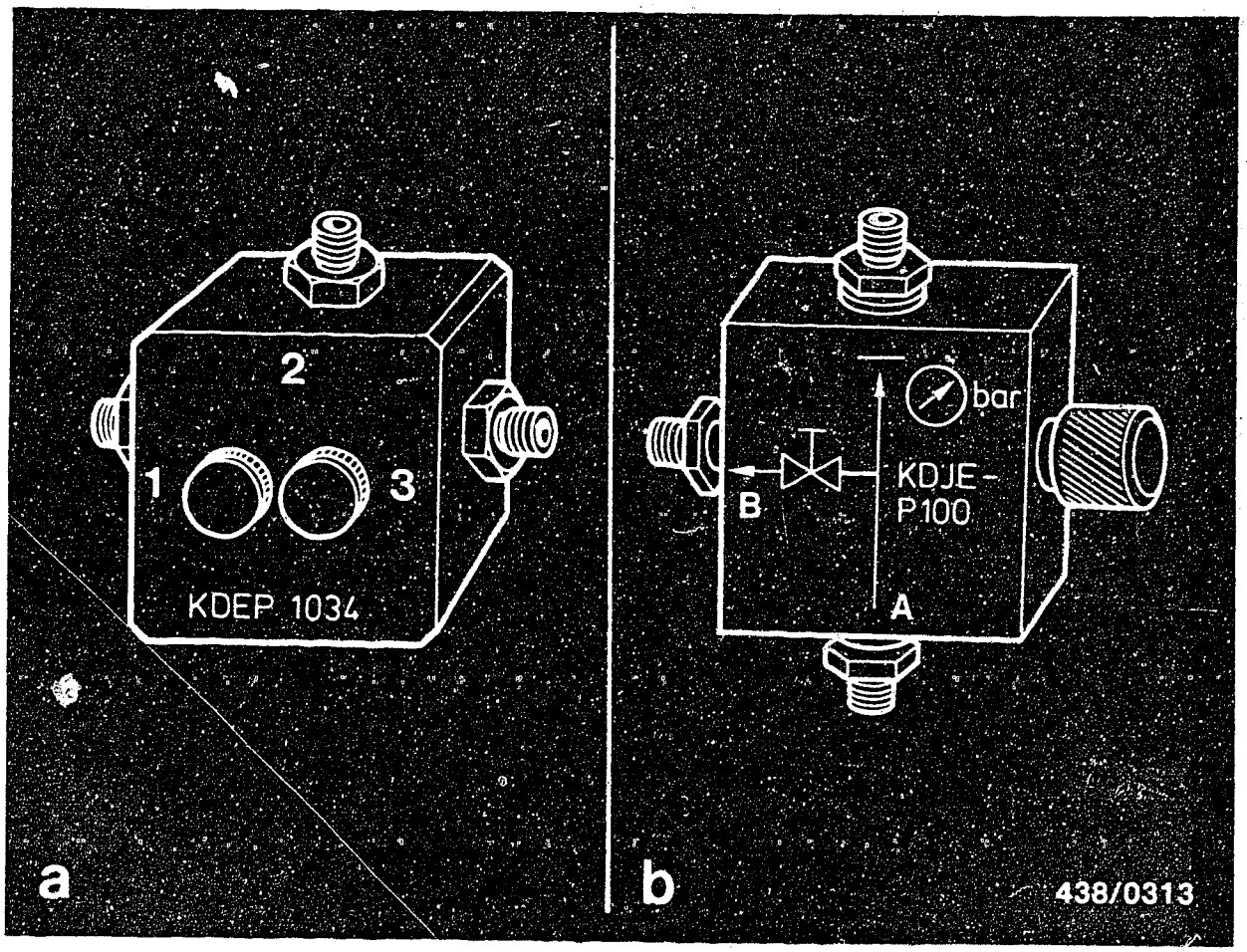
The control piston (Item 3) of the primary-pressure regulator must not be lost. It was matched specially to the fuel distributor housing in the manufacturing plant and therefore is the only part of the primary-pressure regulator which must not be replaced.



16. Testing the entire fuel system for leaks.

16.1 Mounting the pressure tester KDJE-P 100 (formerly KDEP 1034):

The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a).

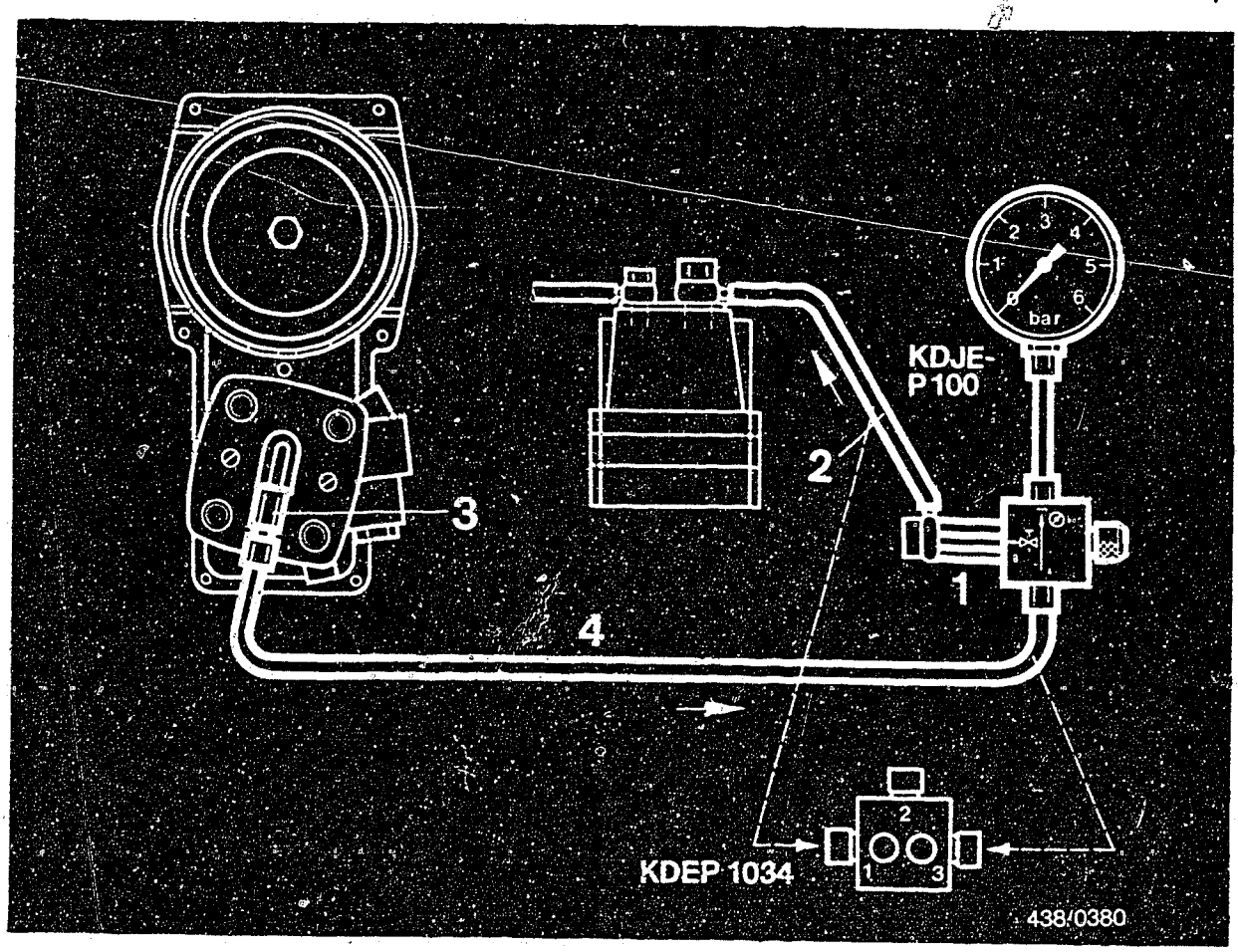


Since the end of 1979 the pressure tester KDJE-P 100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional-control valve are identified by symbols:

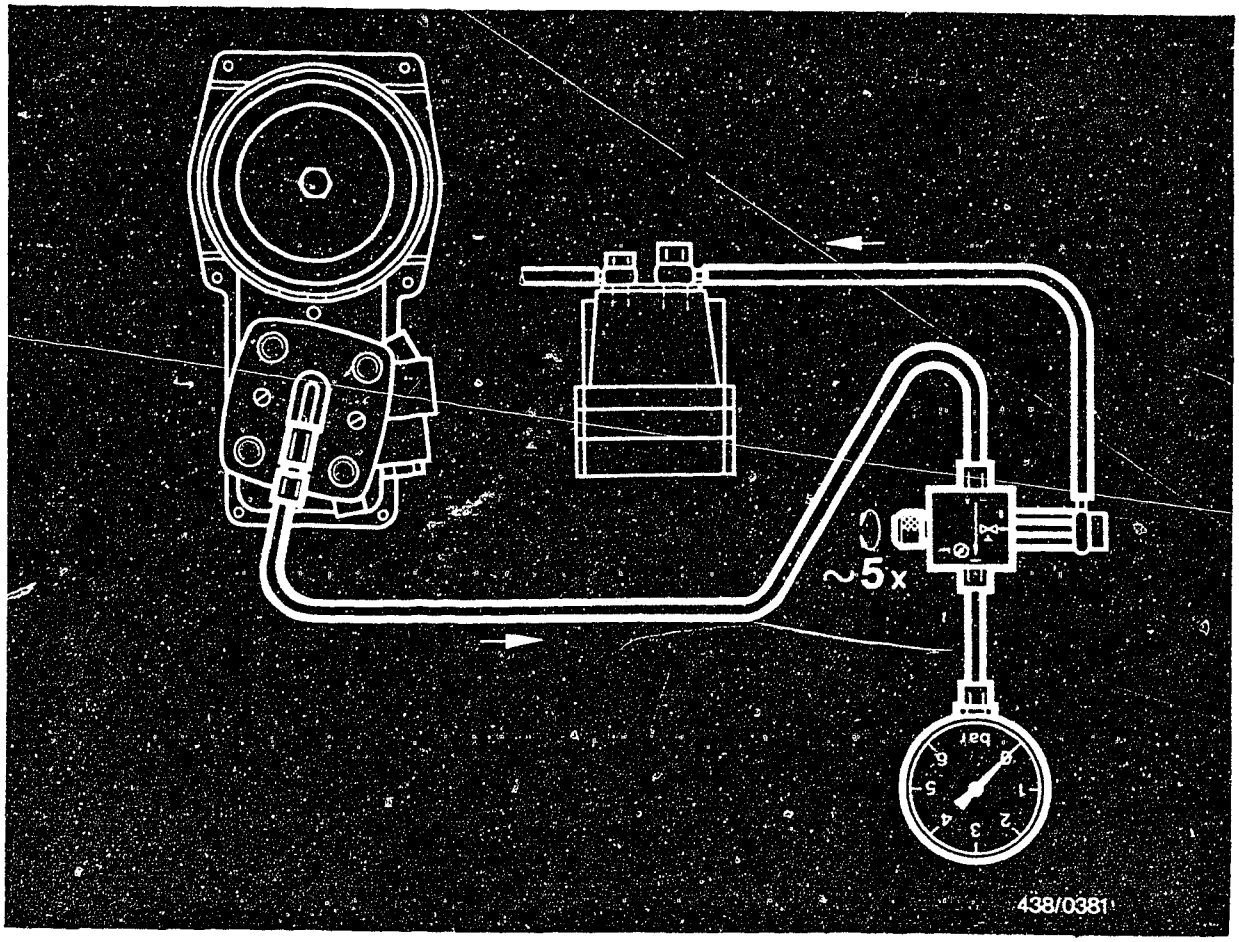
A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)

Caution:

When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.



The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.
Install using connecting-parts set KDJE-P 100/10 (previously KDEP 1034/10).
Screw the adapter (1) with seal ring onto the outlet fitting B or 1 of the directional-control valve.
Unscrew the control-pressure line (2) from the fuel distributor and connect to the adapter with inlet-union screw M 8x1 and seal rings.
Screw the connecting piece (3) of the connecting-parts set into the control-pressure connection port of the fuel distributor and connect to inlet fitting A or 3 of the directional-control valve via hose line (4).
Suspend the pressure gauge from the engine-compartment lid (possibly using a wire hook).

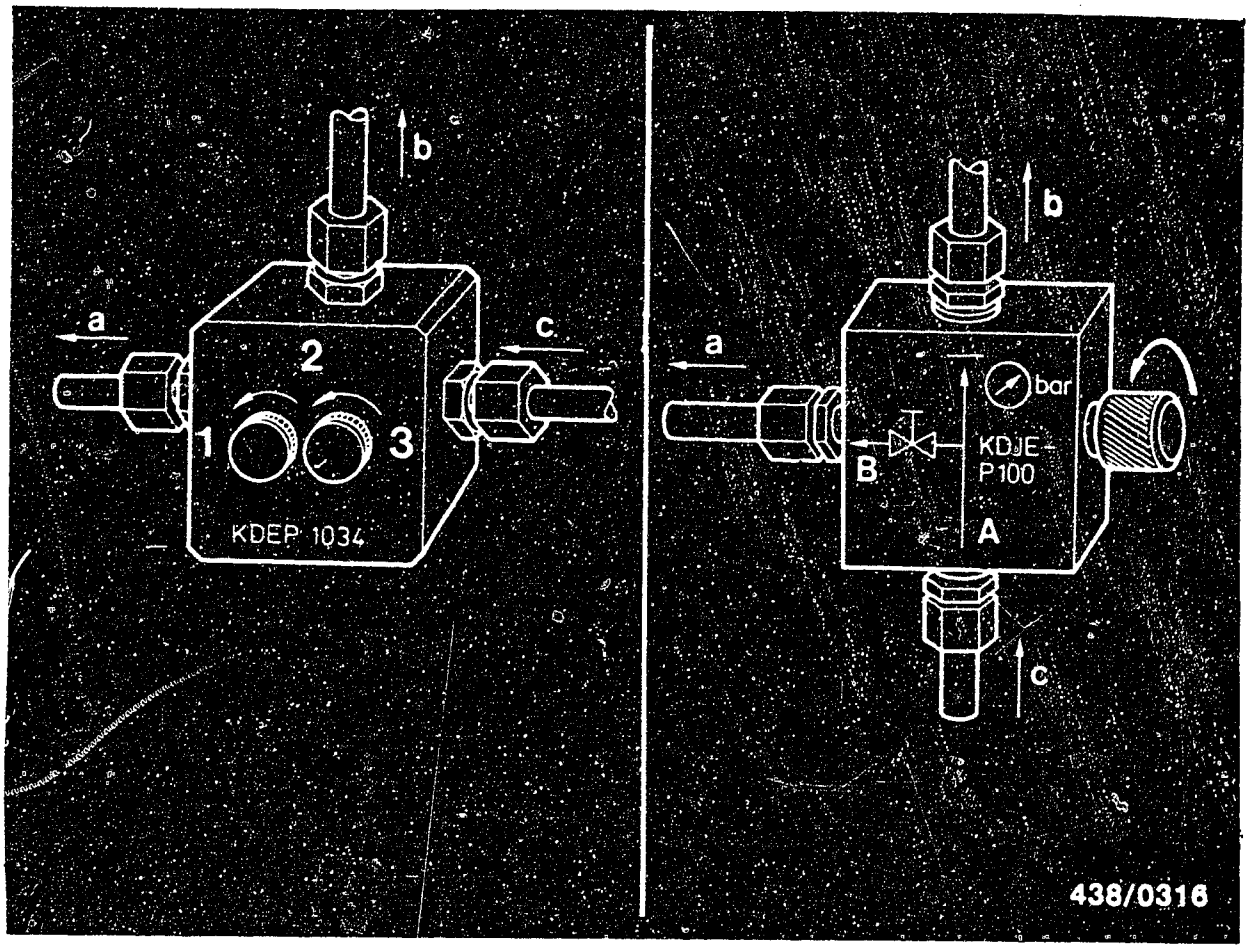


16.2 Bleeding the pressure tester

Disconnect the electric plug from the warm-up regulator. Let the pressure gauge hang down (hose fully extended). Switch on the electric fuel pump by bridging the electrical safety circuit.

Open and close the valve screw(s) of the directional-control valve in a 10-second rhythm about 5 times.

Then hang the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood). Open valve screw of directional-control valve (both screws in the case of KDEP 1034)(turning to the left).



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

16.3 Leak test

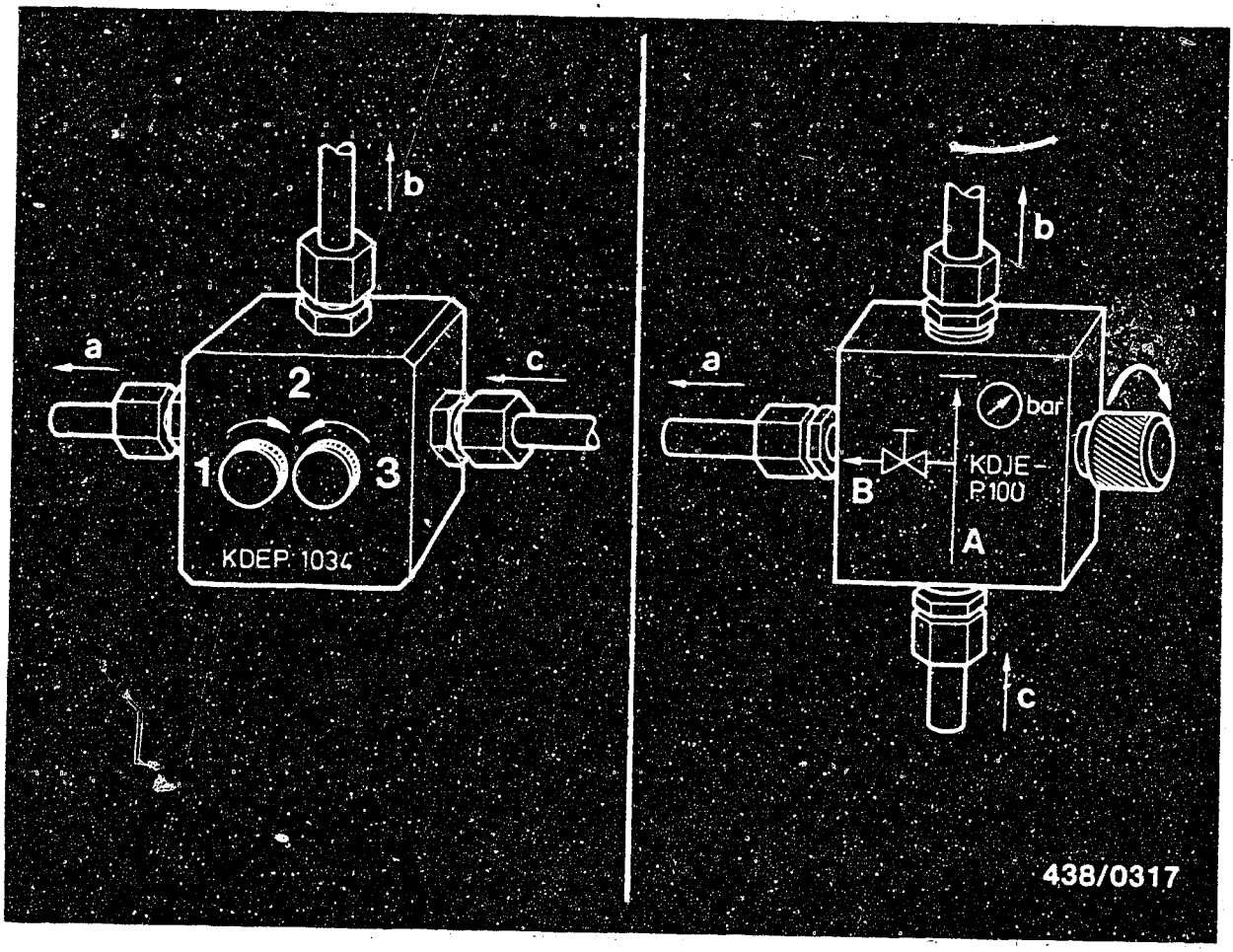
The test is performed with the engine switched off. Make the test with a warm engine but not immediately after the engine has been operated at a high temperature.
Open the valve screw of the directional-control valve (both valves in the case of KDEP 1034).

Switch on the electric fuel pump by bridging the electrical safety circuit until the warm-up regulator has ceased to operate ("warm" control pressure).

Switch the electric fuel pump off again and observe the drop in pressure on the pressure gauge.

Test specifications for leak test:

Minimum pressure (gauge pressure)
after 10 minutes: 1.9 bar (2.0 kgf/cm^2)
after 20 minutes: 1.7 bar (1.8 kgf/cm^2)

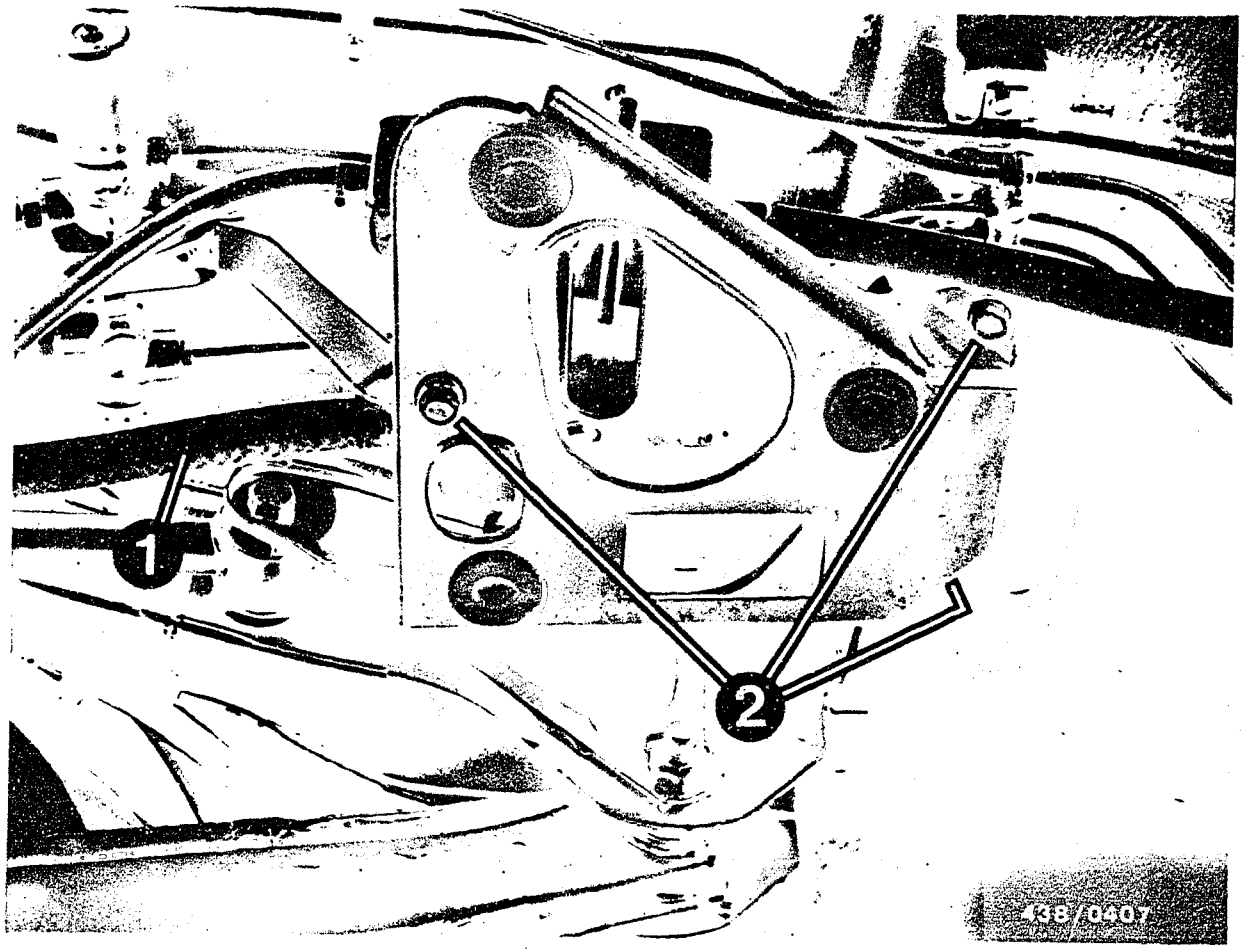


a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

If the pressure drops too quickly, repeat the test with the control-pressure circuit disconnected.

Position of the valve screws:
Close the valve screw of the directional-control valve KDJE-P 100.
In the case of KDEP 1034, close valve screw 1, open valve screw 2.

If the same result is found, the leak is in the primary-pressure circuit.
If the test results are correct during the second test, the leak is in the control-pressure circuit.



16.4 Possible causes of faults in the primary-pressure circuit:

- Non-return valve in the tube fitting of the electric fuel pump leaking.

 Part no. of electric fuel pump:
 1978/1979 model = 0 580 254 996
 1980/1981 model = 0 580 254 972

The non-return valve is integrated in the tube fitting on the delivery side of the pump. If leaking, replace the tube fitting.

Part number of tube fitting:

For pump 0 580 254 996 = 1 583 386 011
Special seal ring = 1 580 203 001

For pump 0 580 254 972 = 1 583 386 016
Seal ring = 1 580 105 001

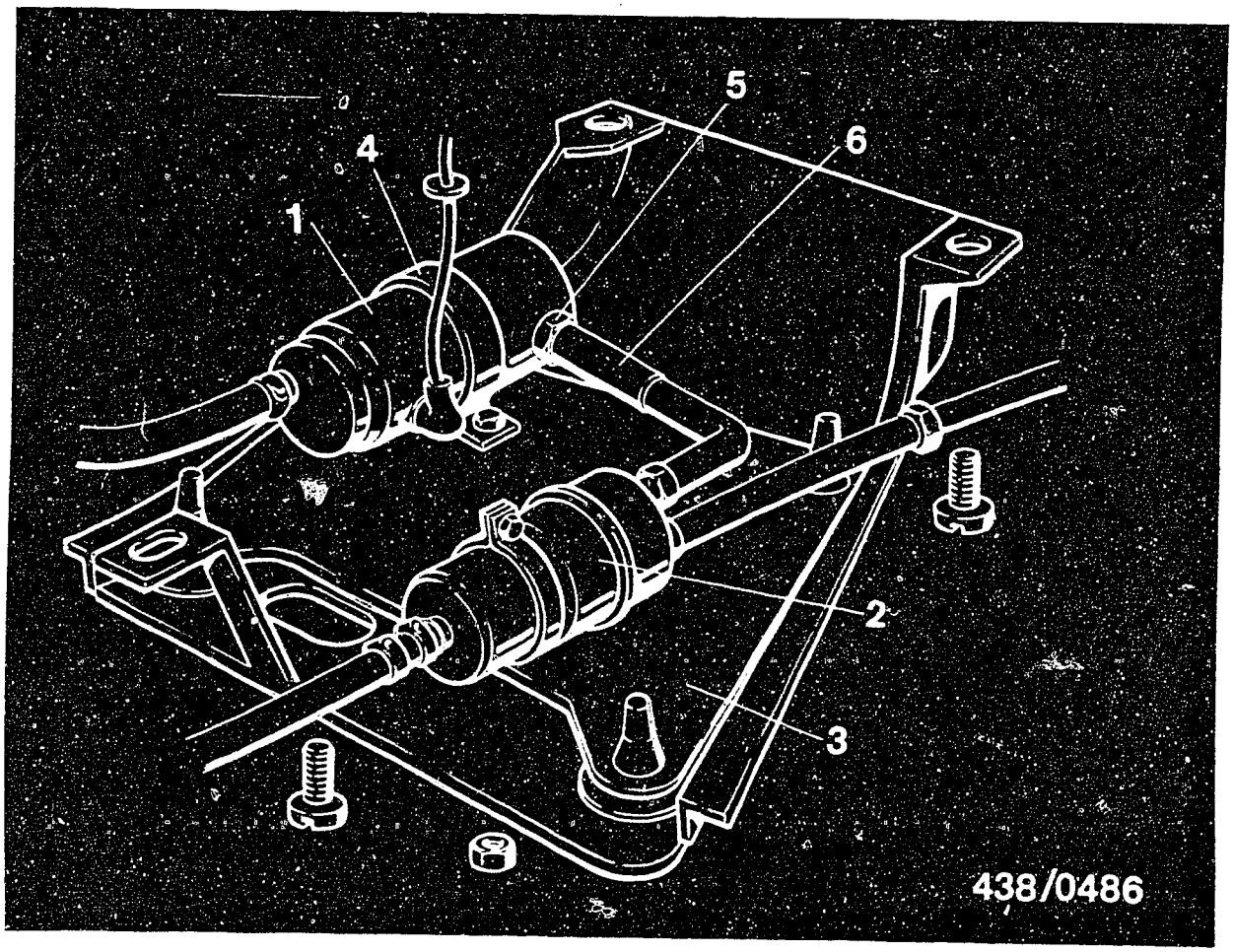
In order to make the electric fuel pump accessible, remove the bracket as follows:

Pinch off the intake hose (1) (e.g. using hose clamper W 157 from Matra Co.) so that no fuel can escape from the fuel tank.

Loosen the hose clip and remove the intake hose from the intake fitting on the electric fuel pump.

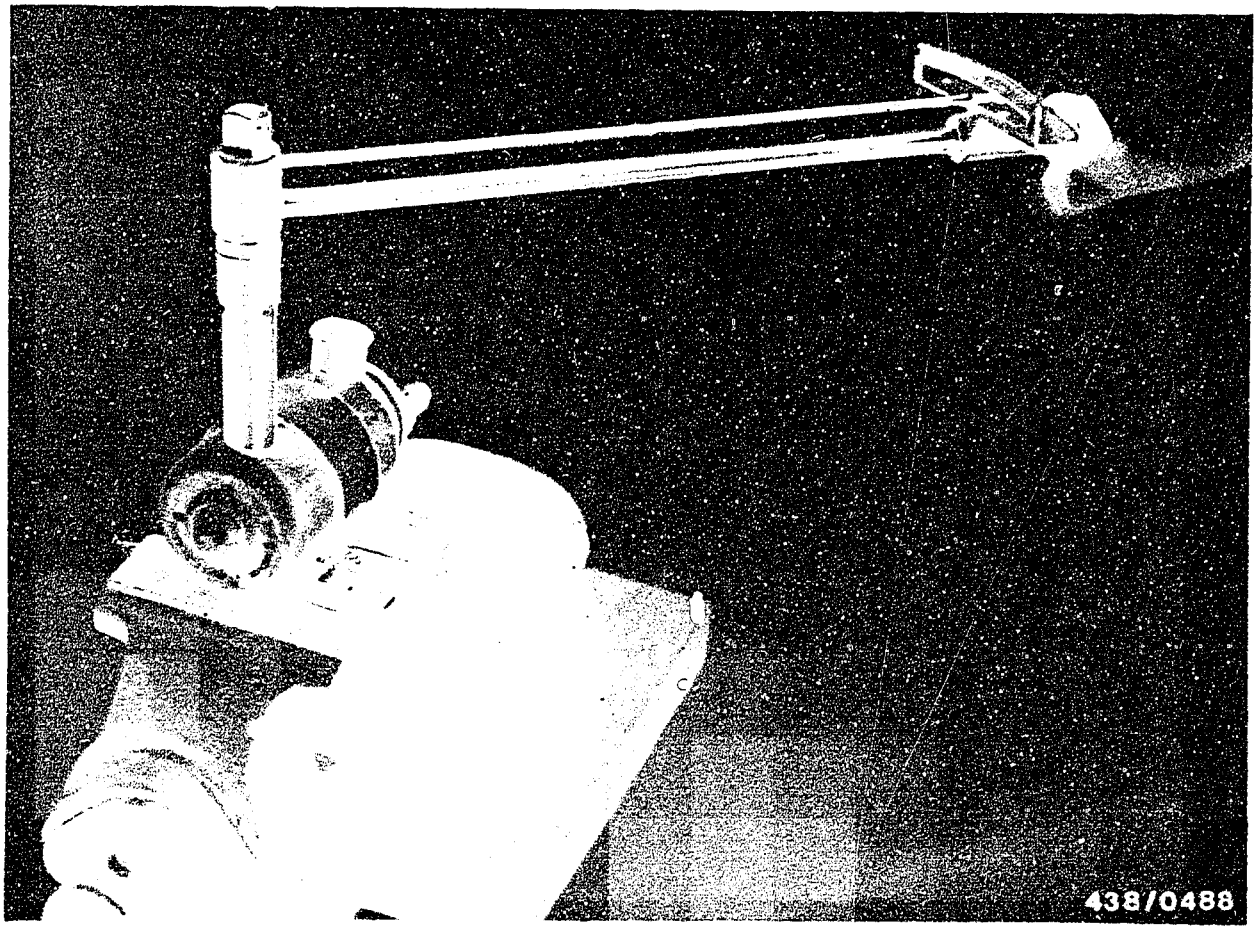
Remove the complete bracket by loosening the 3 fastening screws (2, one of the screws not visible in the picture) and hold slightly downward with the accumulator lines connected. Make sure that the lines still connected are not damaged.

The removal and installation of the tube fitting is different for the two versions of pump and is described below.



1 = Electric fuel pump
2 = Fuel accumulator
3 = Bracket
4 = Clamping clip
5 = Delivery fitting with non-return valve
6 = Delivery line

Replacing the tube fitting with non-return valve in the case of electric fuel pump 0 580 254 996 in the 1978/ 1979 model (pump type EKP I with steel housing and lateral tube fitting):
Remove the complete electric fuel pump. To do this, unscrew the delivery line (6) from the accumulator (2). Screw off the clamping clip (4) and remove the pump from the bracket.

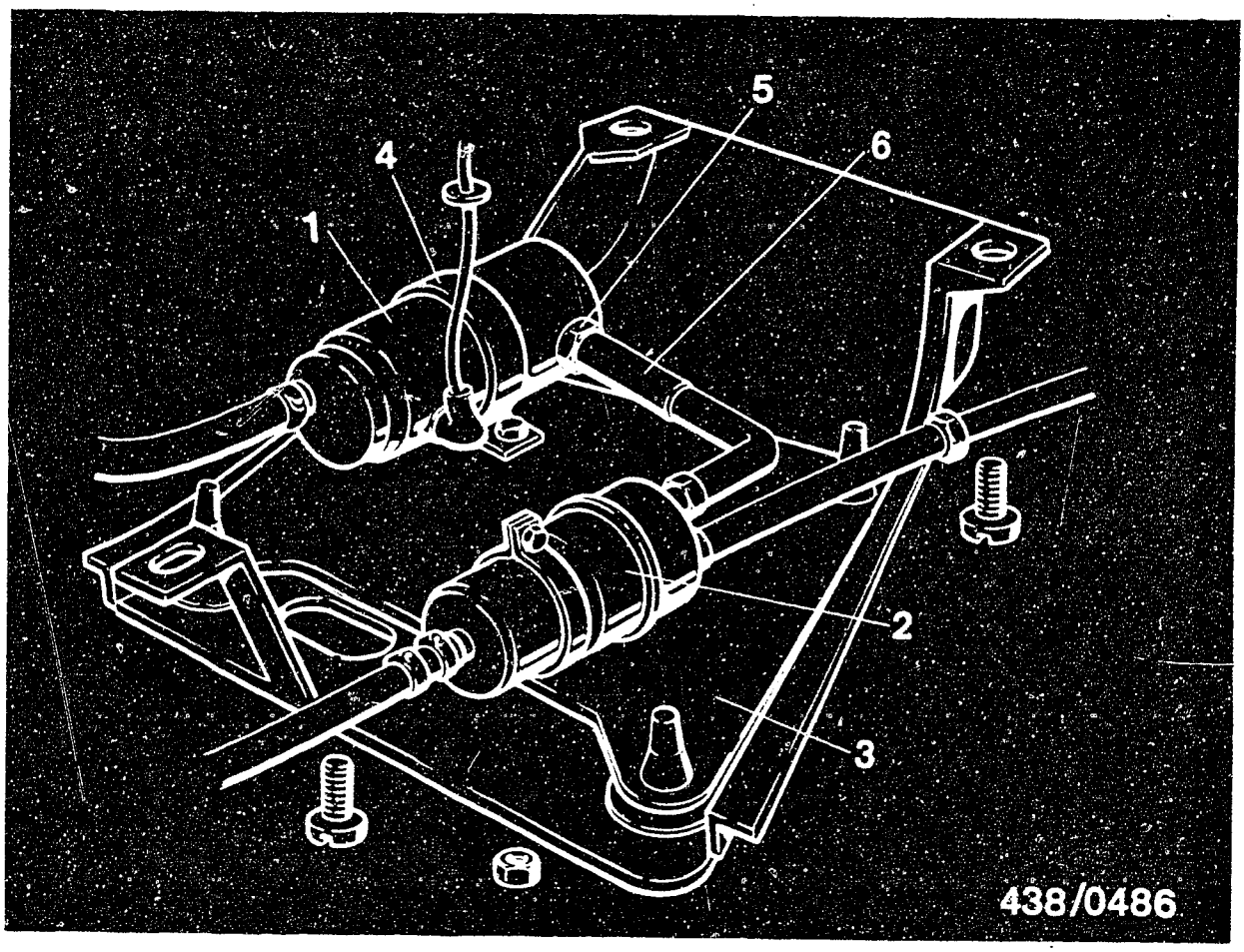


Clamp the pump in a vise by the clamping clip (never clamp by the pump housing). Remove the delivery hose from the tube fitting and screw off the fitting.

Caution: No dirt or chips must get into the inside of the pump.

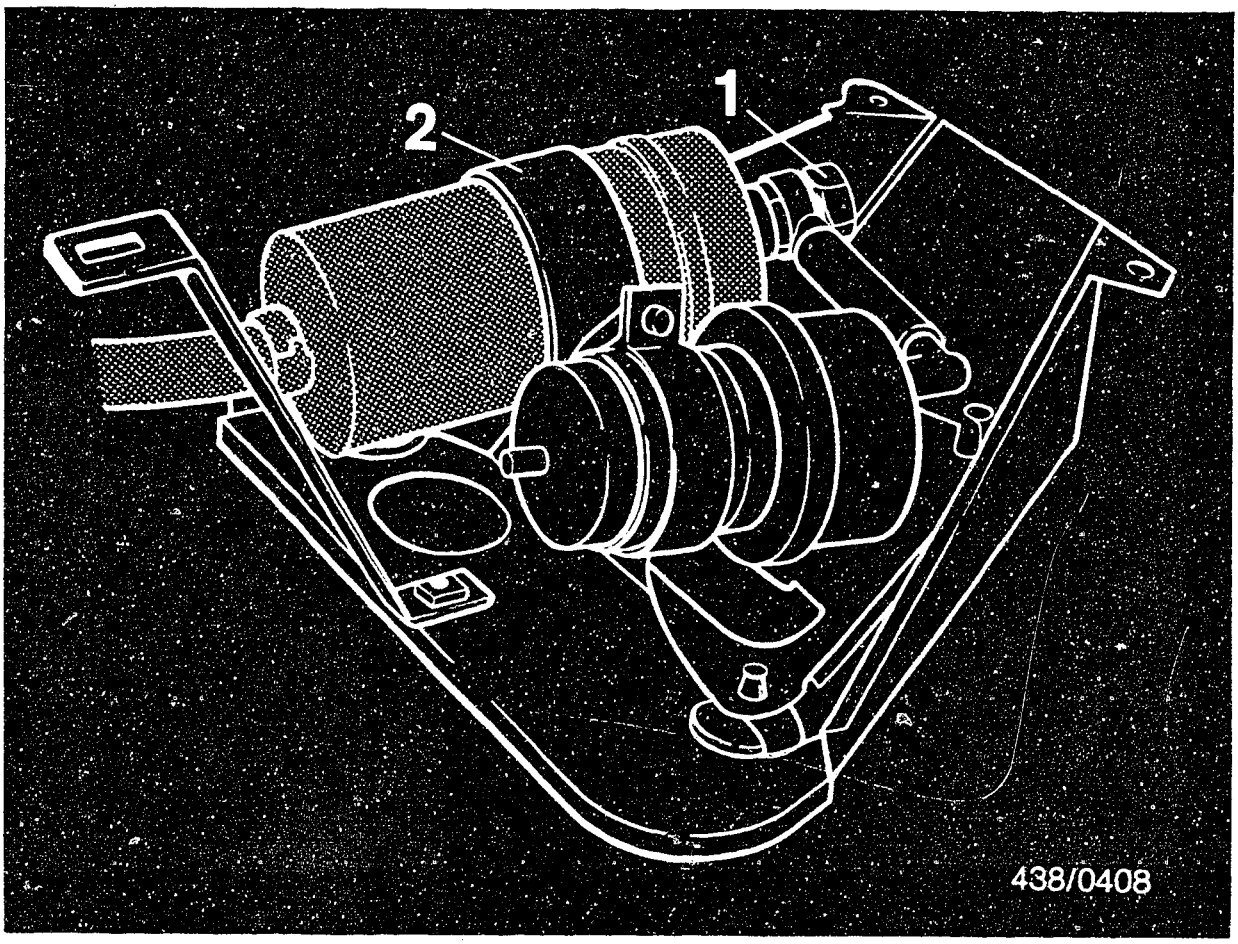
Always screw in a new tube fitting with a new seal ring. Tightening torque 16...20 Nm (1.6...2.0 kgfm).

Caution: Use only the specified seal ring, since it is of special dimensions. Always observe the specified tightening torque and do not exceed, otherwise there is the danger of warping the housing and damaging the thread.



Install in the reverse order, ensuring that the delivery line (6) is in proper condition and that it is securely seated on the delivery fitting (5). If necessary, use a new delivery line (Volvo service part).

Finally, check all connections for leaks with the pump operating.

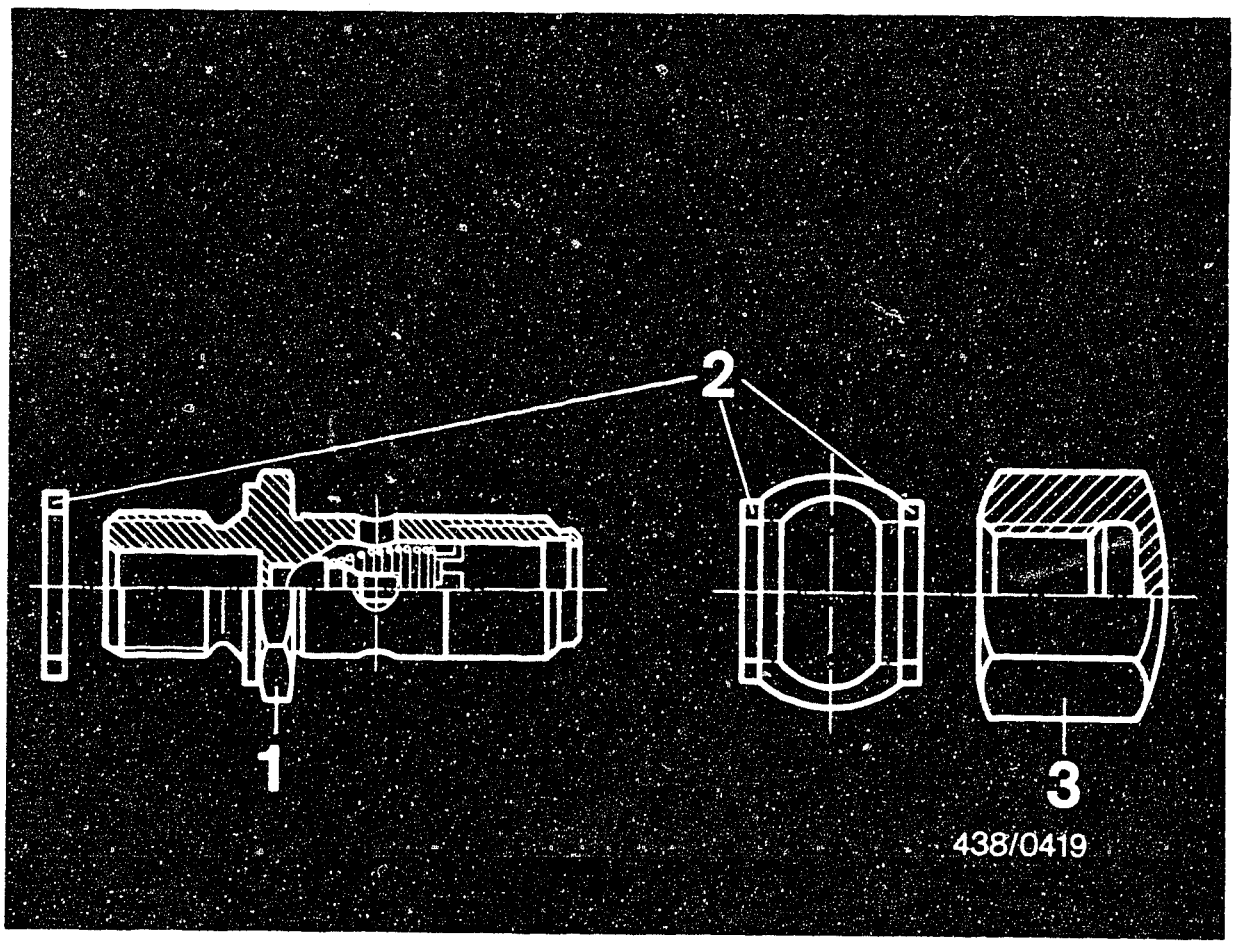


Changing the tube fitting with non-return valve in the case of electric fuel pump 0 580 254 792 in the 1980/ 1981 model (pump type EKP IV, intake and delivery fittings in the longitudinal direction of the pump):

Screw off the cap nut (1), applying counter-force at the hexagonal section of the tube fitting.

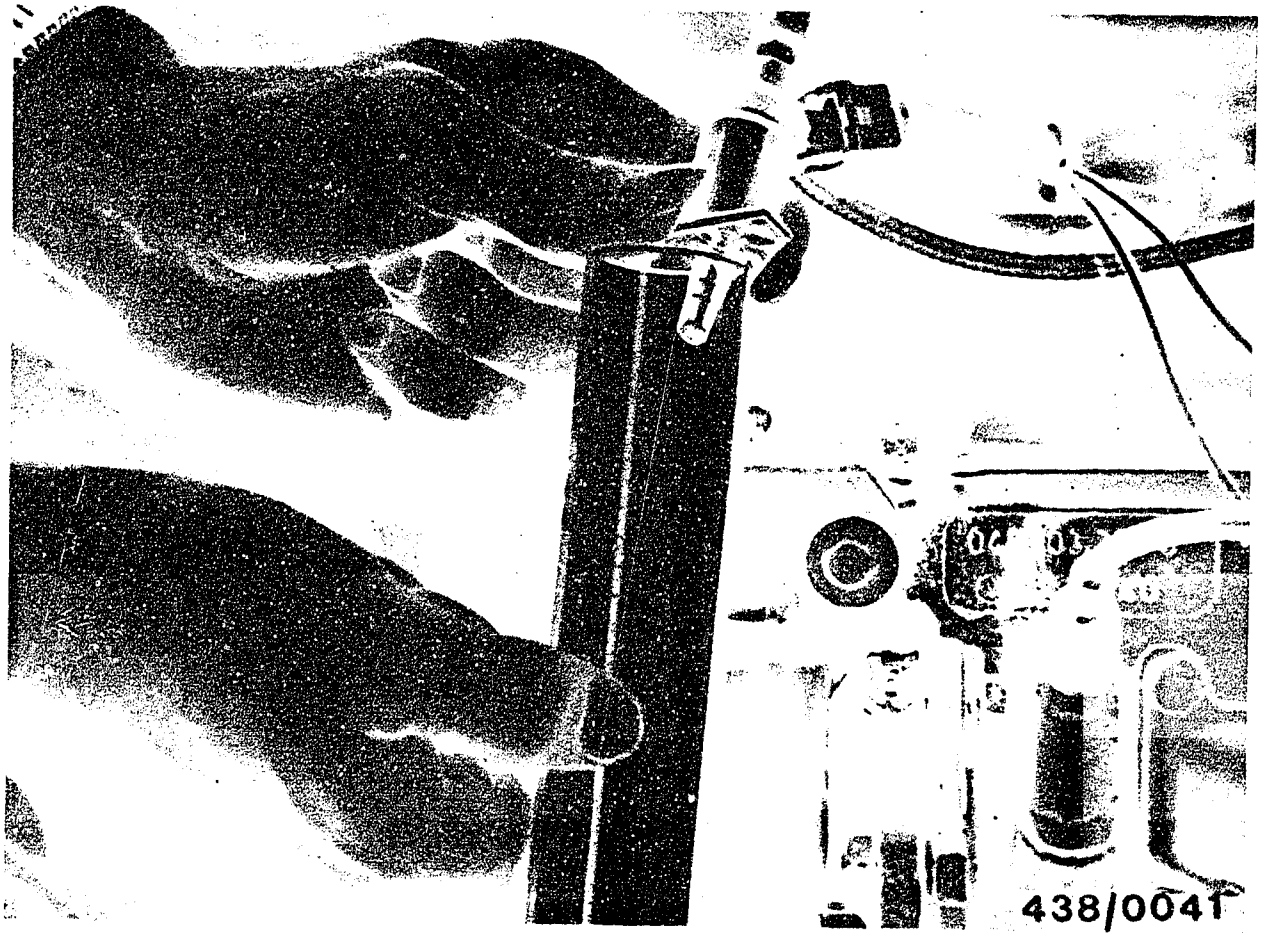
Loosen the clamping clip (2) and pull the electric fuel pump back slightly..

Unscrew the tube fitting, applying counter-force at the fixed hexagonal section on the pump housing with a flat box wrench.



Screw a new tube fitting (1) with non-return valve into the delivery fitting with a new seal ring (2) and tighten to a torque of 17...25 Nm (1.7...2.5 kgfm).

Place the pump back in its installation position, introducing the tube fitting into the inlet union of the delivery line. Do not forget new seal rings (2) on either side of the inlet union.
Screw on the cap nut (3) and tighten to a torque of 17...25 Nm (1.7...2.5 kgfm).
Re-tighten the clamping clip, re-install the bracket and connect the intake hose.
Finally, check all connections for leaks with the pump operating.



Further possible cause of leaks in the primary-pressure circuit:

- Start valve leaking.

Remove the plug from the start valve and remove the start valve. The fuel line remains connected.

Hold the start valve in a suitable vessel (e.g. a graduate).

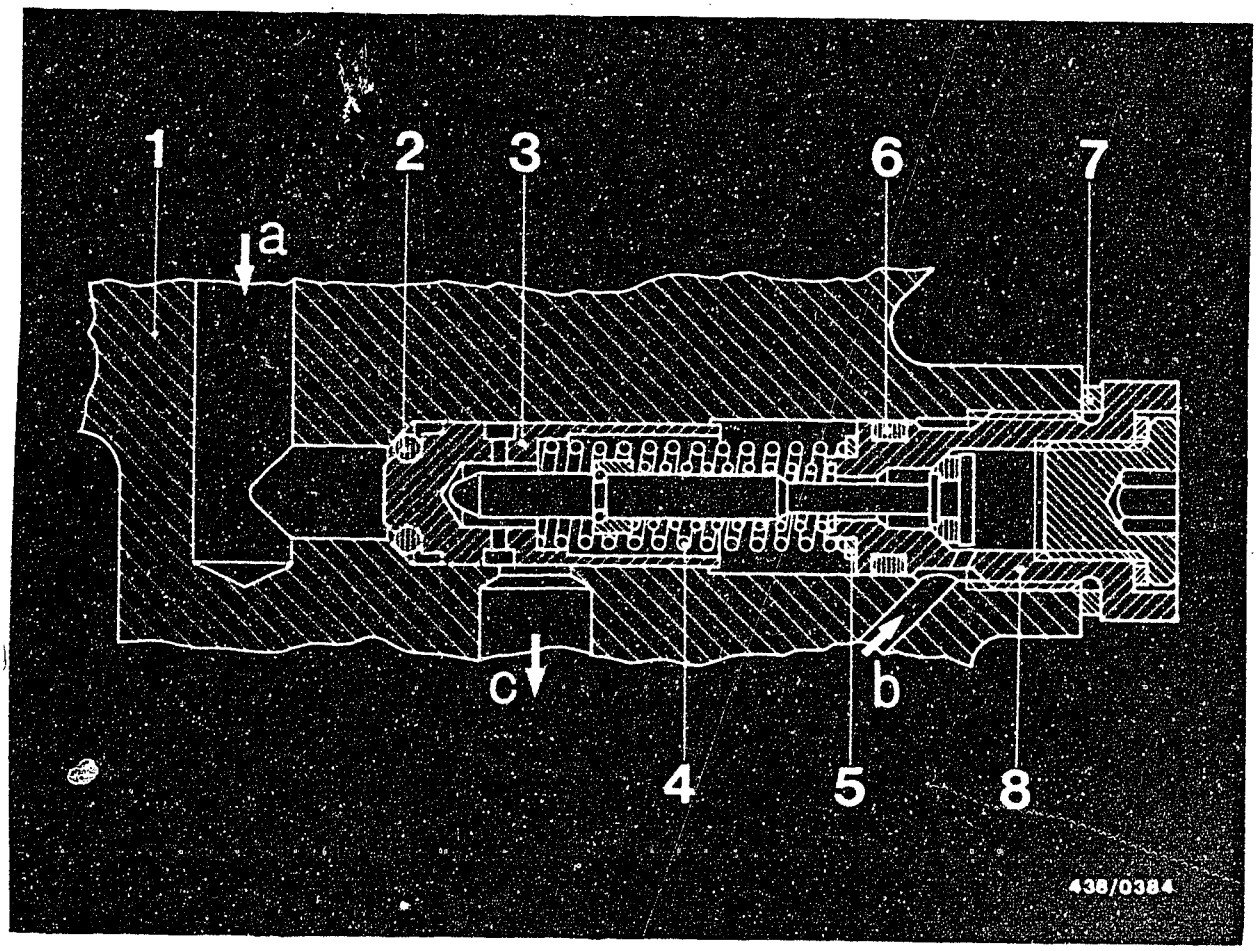
Switch on the electric fuel pump by bridging the electrical safety circuit so that primary pressure is applied to the start valve.

Dry off the nozzle of the cold-start valve.

No drops must fall from the nozzle of the start valve within the next minute. Even when shaken and knocked, the start valve must not leak.

Switch the electric fuel pump off again.

Replace the cold-start valve if leaky.
Finally, adjust idle speed with the engine at operating temperature.
Idle-speed adjustment is described on Coordinates F 19.



a = Primary pressure
b = From warm-up regulator
c = Fuel return
1 = Fuel-distributor housing
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = O-ring
7 = Flat seal ring
8 = Screw plug

- Seal ring (O-ring) on control piston of primary-pressure regulator has a leak.

Replace the seal ring.
Clean the fuel distributor in the region of the primary-pressure regulator.

Unscrew the large screw plug (8) with the complete push-up valve. Also remove the shims (5), control spring (4) and control plunger (3).

Replace the seal ring (O-ring) (2) on the control plunger. Install the control plunger and the control spring.

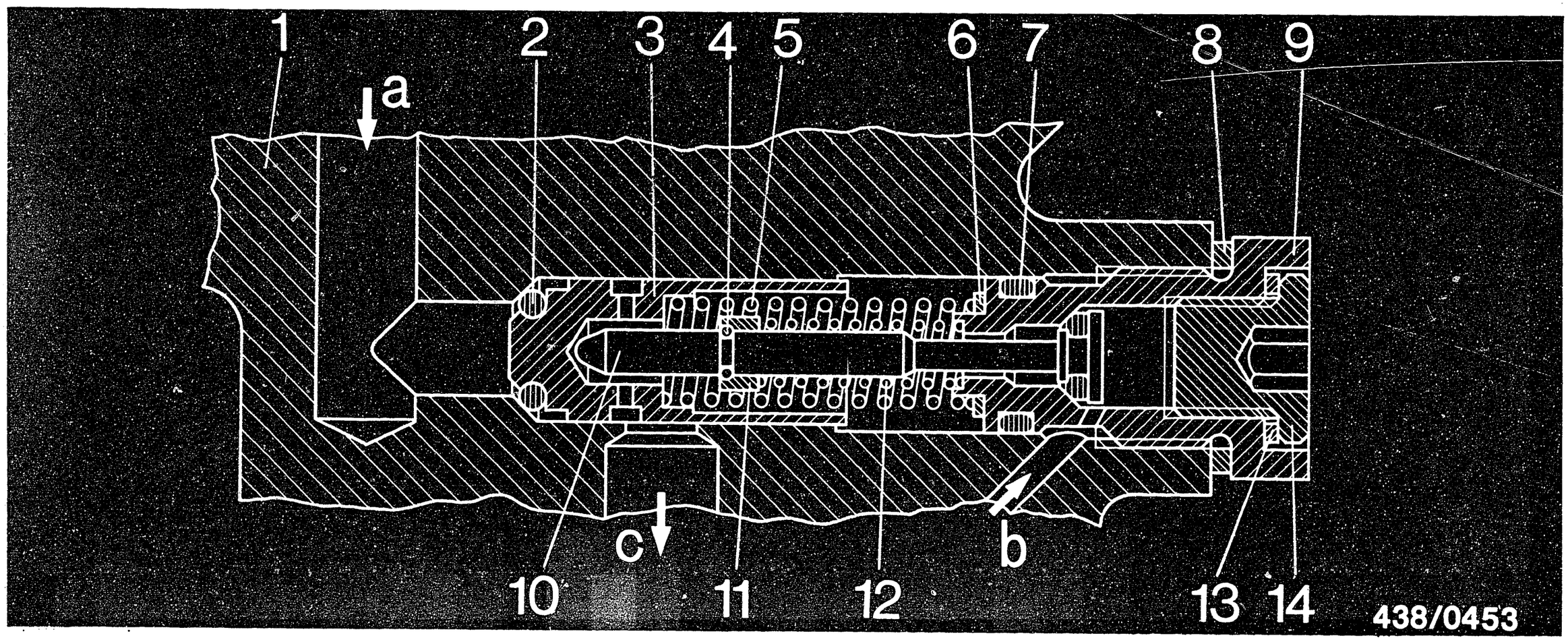
Screw in the screw plug with the complete push-up valve and with shims (as found when removing) and new seal rings (6 and 7).

Finally, check the primary pressure and, if necessary, adjust by changing the shims (5).

Primary pressure:

Fuel distributor 0 438 100 023
Fuel distributor 0 438 100 074

Checking value 4.5...5.2 bar (4.6...5.3 kgf/cm²) gauge pressure
Setting value 4.7...4.9 bar (4.8...5.0 kgf/cm²) gauge pressure



a = Primary pressure
b = From warm-up regulator
c = Fuel return

1 = Fuel-distributor housing
2 = O-ring
3 = Control piston
4 = Retaining ring
5 = Spring
6 = Shims
7 = O-ring
8 = Seal ring
9 = Screw plug
10 = Valve needle
11 = Retainer
12 = Spring
13 = Flat seal ring
14 = Screw plug

16.5 Possible causes of a defect in the control-pressure circuit:

The push valve in the primary-pressure regulator has a leak.
Since the seal ring of the push valve is rigidly vulcanized onto the valve needle, the screw plug must be changed with the complete push valve (ready-assembled unit).

This also applies when replacing earlier versions of the push-up valve with a loose O-ring on the valve needle. The O-ring is no longer obtainable as a separate part. Therefore, if necessary, always install the complete valve unit.

Clean the fuel distributor in the region of the primary-pressure regulator. Unscrew the large screw plug (9) with the complete push-up valve. Pay attention to the control spring (5) and the shims (6).

Screw in the new push-up valve with the previously found number of shims (6), a new O-ring (7) and flat seal ring (8).

Then check the primary pressure once again and, if necessary, adjust by changing the shims (6).

Test specifications and settings for the primary pressure:

Fuel distributor 0 438 100 023
Fuel distributor 0 438 100 074

Checking value 4.5...5.2 bar (4.6...5.3 kgf/cm²) gauge pressure
Setting value 4.7...4.9 bar (4.8...5.0 kgf/cm²) gauge pressure



17. Testing the injection valves.

Remove the injection valves for testing. They are inserted into appropriate bores in the cylinder head and are located by holding plates (arrow).

Unscrew the fuel lines. Screw out the fastening screws. Lift off the holding plates and remove the valves from the bores.

When re-installing the injection valves, the O-rings on the valve stems should if possible be replaced (Volvo service part) in order to prevent leaks and thus the entry of unmetered air.

17.1 Test equipment and test media

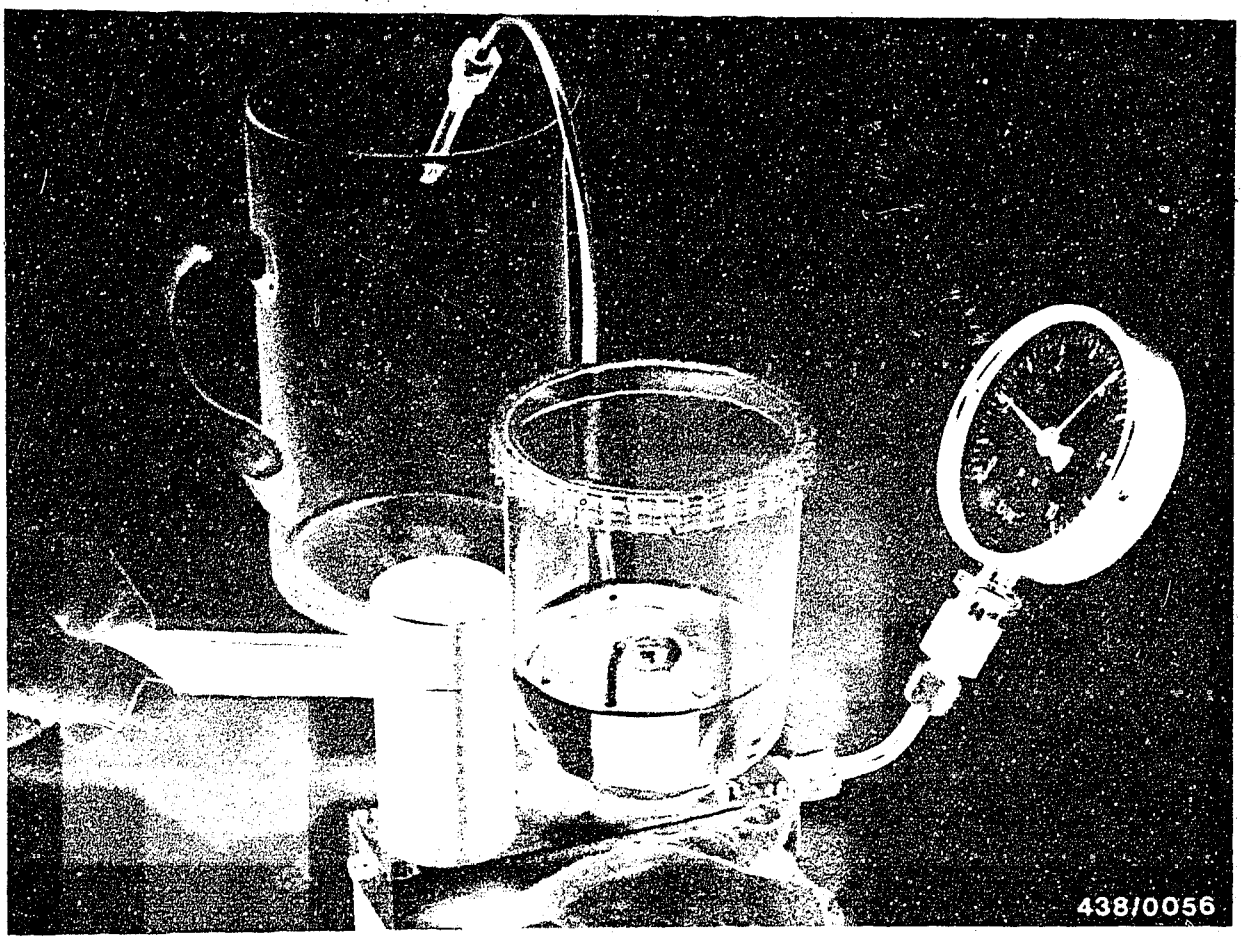
The following testing specification refers to valve testers KDJE-P 400 (previously KDEP 7452) and 0 681 200 700.

Observe the test-media specification!

Test media: Calibrating fluid (Shell K 30, Esso-Varsol, Shell Mineral Spirits 135)
or
Bosch, Part No. VS 14 942-CH
Former Part No. 5 973 340 650
The calibrating fluid can be obtained in 5 l metal cans from the following supplier:

Firma
Oskar Gnamm GmbH
D-7531 Kämfelbach-Bilfingen

Caution:
For safety reasons, never use normal gasoline or similar easily inflammable and combustible liquids.
Even with calibrating fluid, be sure to observe the local official regulations.

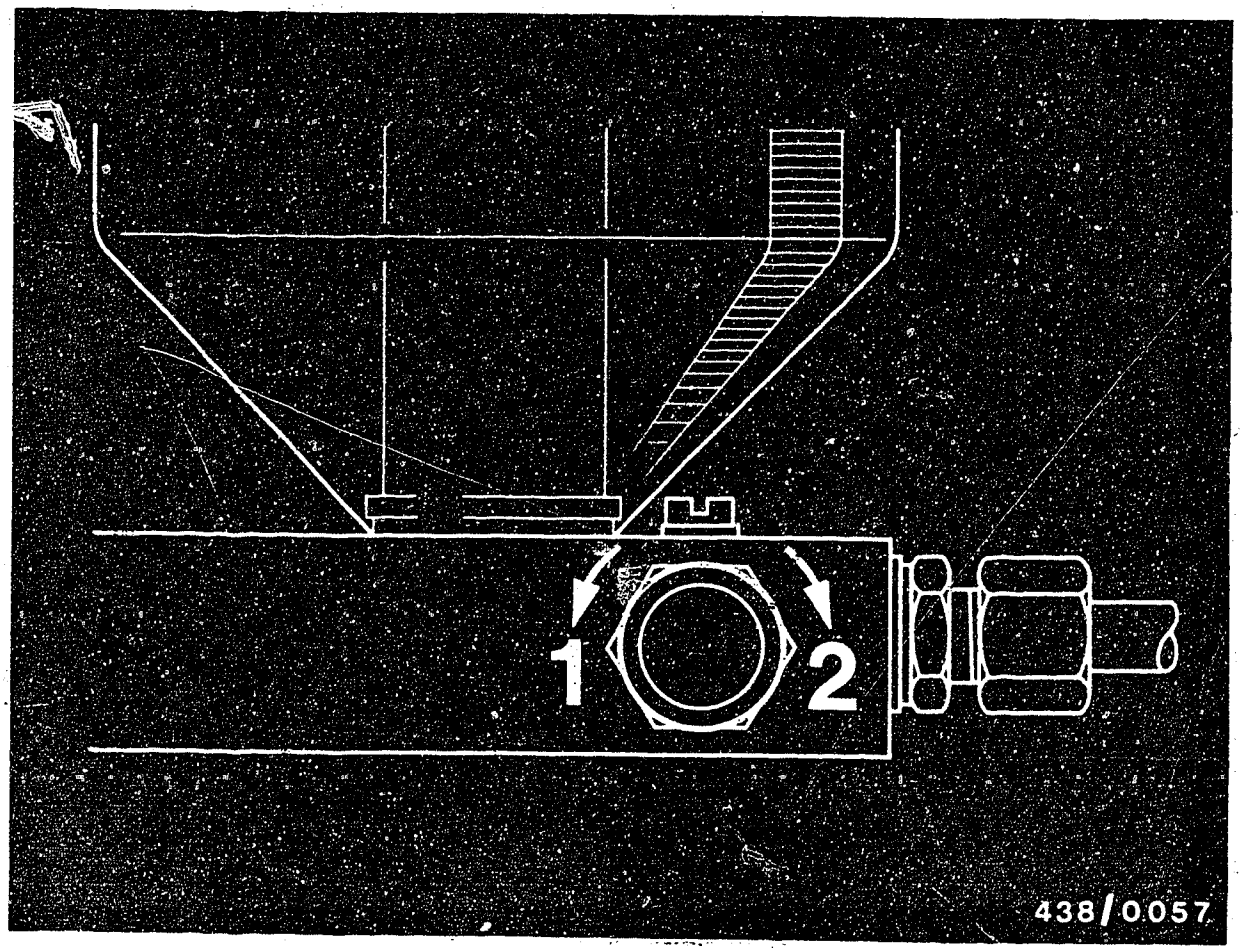


17.2 Connecting the injection valve to the tester

Connect the injection valve to the valve tester and bleed the delivery line by operating the lever several times with the union nut open. Then tighten the union nut.

17.3 Checking for dirt

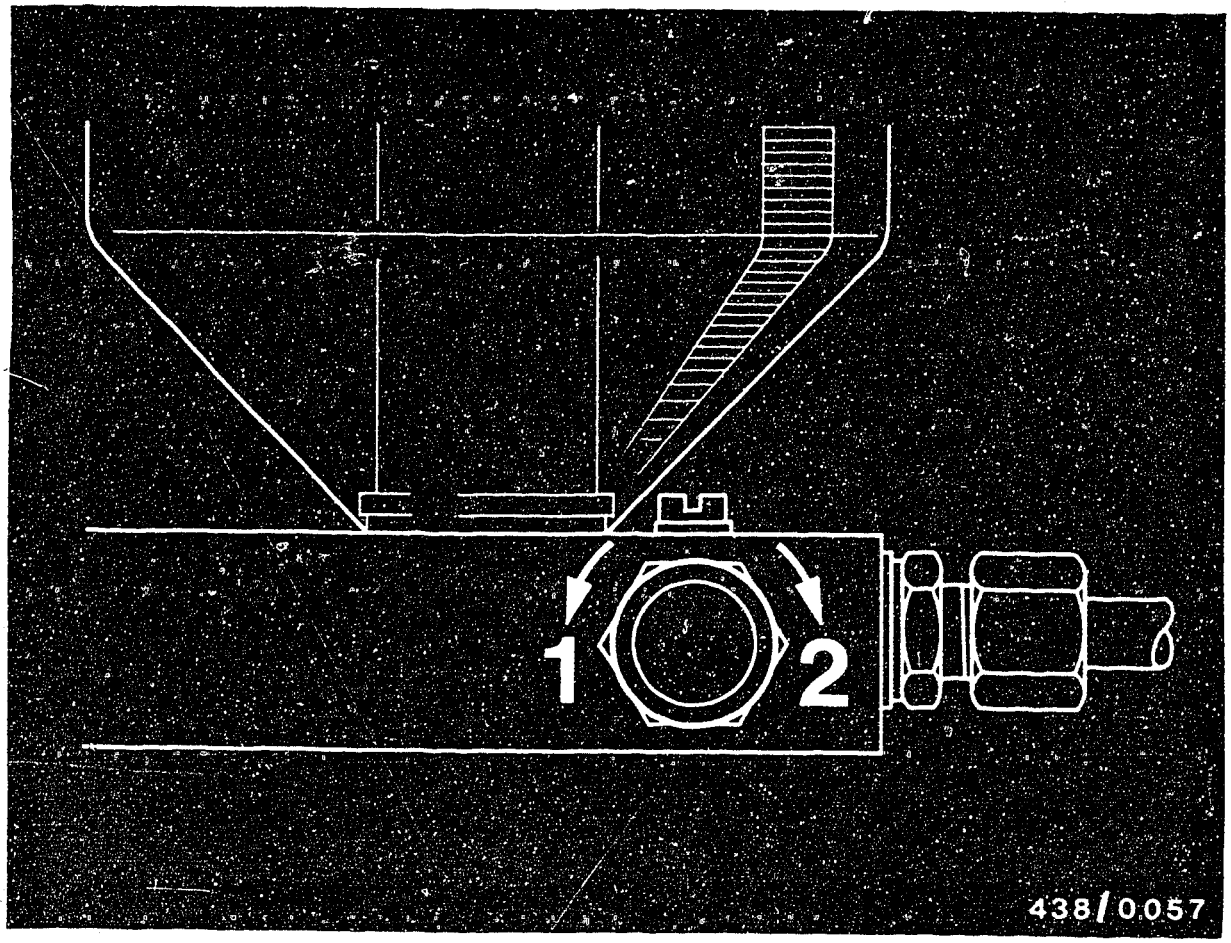
Move the hand lever slowly (about 2 seconds per stroke) back and forth with the stopcock on the pressure gauge open. If the pressure does not build up to 1...1.5 bar gauge pressure, the injection valve has a bad leak (caused, for example, by dirt stuck in it).
You can try to flush the injection valve clear by moving the lever back and forth several times strongly.
If this attempt is successful, continue the test. If it is not possible to flush the valve clear, replace it.



1 = Open 2 = Close

17.4 Testing the opening pressure

Injection valve Part No.	Test specifications - opening pressure (gauge pressure)
0 437 502 007:	2.5...3.6 bar (2.6...3.7kgf/cm²)
0 437 502 015 up to FD 828:	2.7...3.8 bar (2.8...3.9kgf/cm²)
from FD 829:	3.0...4.1 bar (3.1...4.2kgf/cm²)

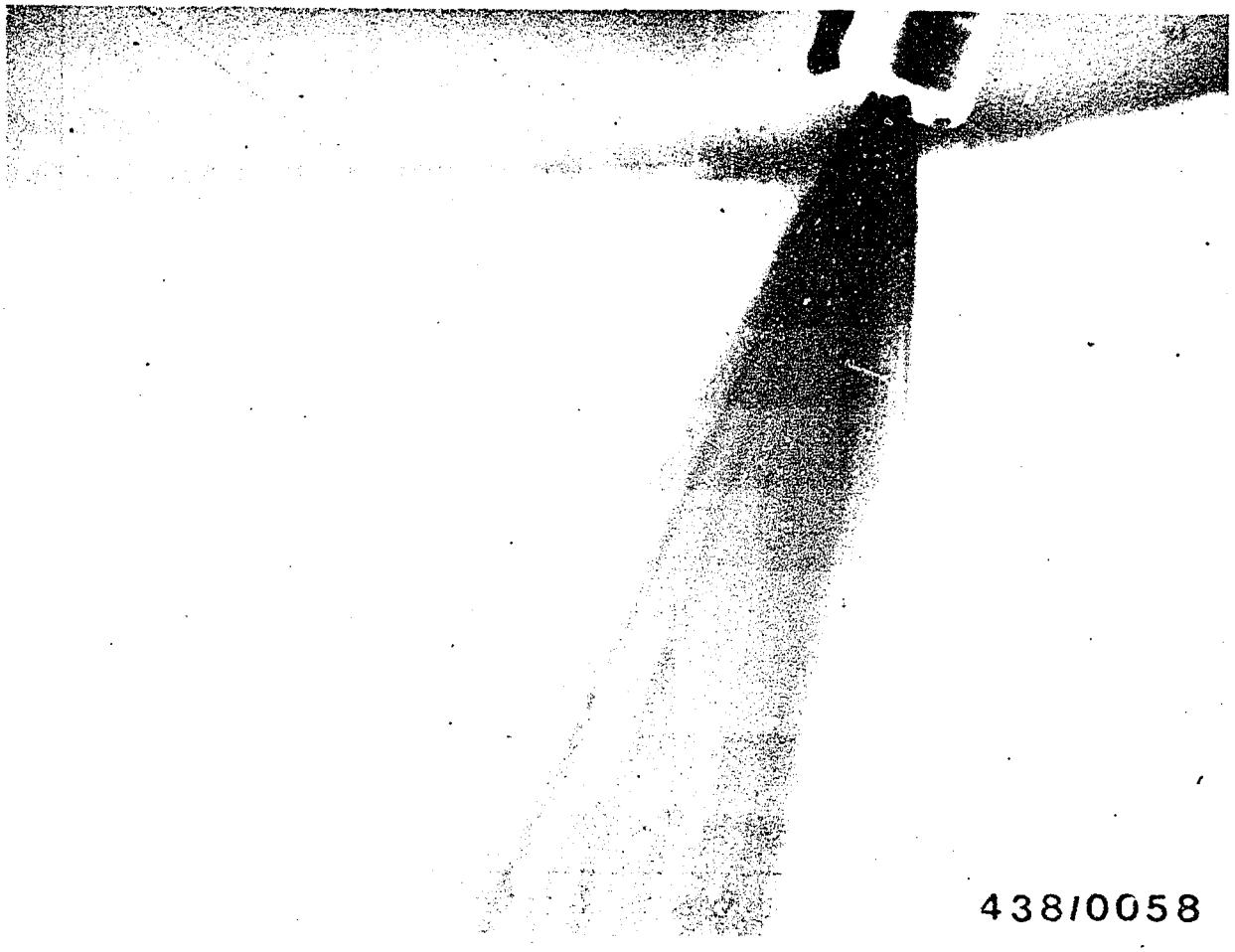


With the stopcock closed, flush the valve out and bleed it with several rapid movements of the lever.
Open the stopcock and test the opening pressure by moving the lever slowly (about 2 seconds per stroke).

If the opening pressure is outside tolerance, replace the injection valve. Individual valves can also be interchanged within a set.

17.5 Leakage test

Open the stopcock, build the pressure up slowly to a value 0.5 bar under the opening pressure determined previously (but not less than 2.3 bar gauge pressure), and hold it constant at that level. No drops must now fall from the valve for the next 15 seconds.

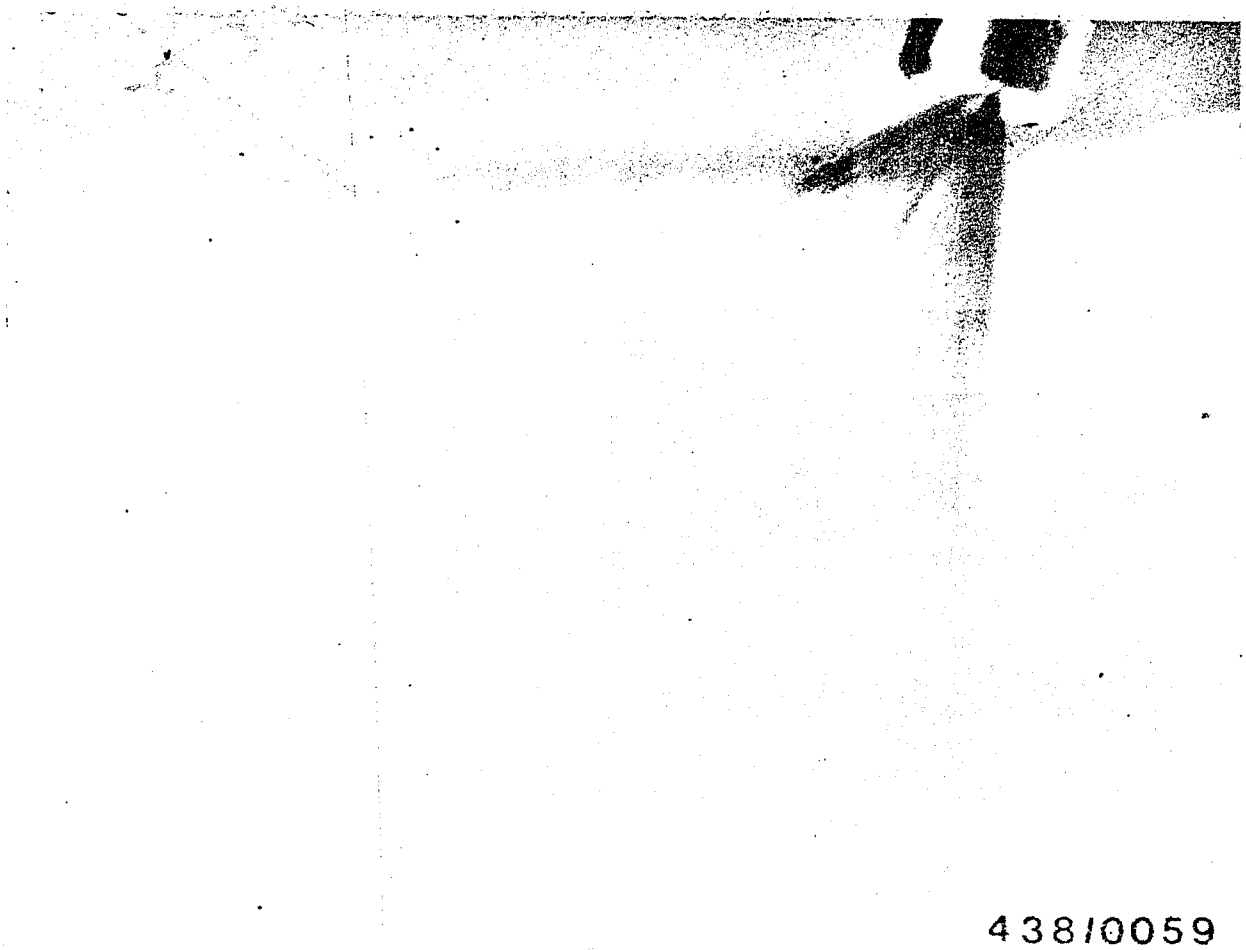


438/0058

17.6 Chatter test, evaluation of spray

Move the lever back and forth at about 1 stroke per second. As this is done, the valve must chatter. No drops of fuel must form at the mouth of the valve. The valve must not produce a "cord spray". Formation of a single-sided, atomized spray within an overall spray angle of about 35° is permissible (see example given in illustrations).

Illustration shows good spray formation.



438/0059

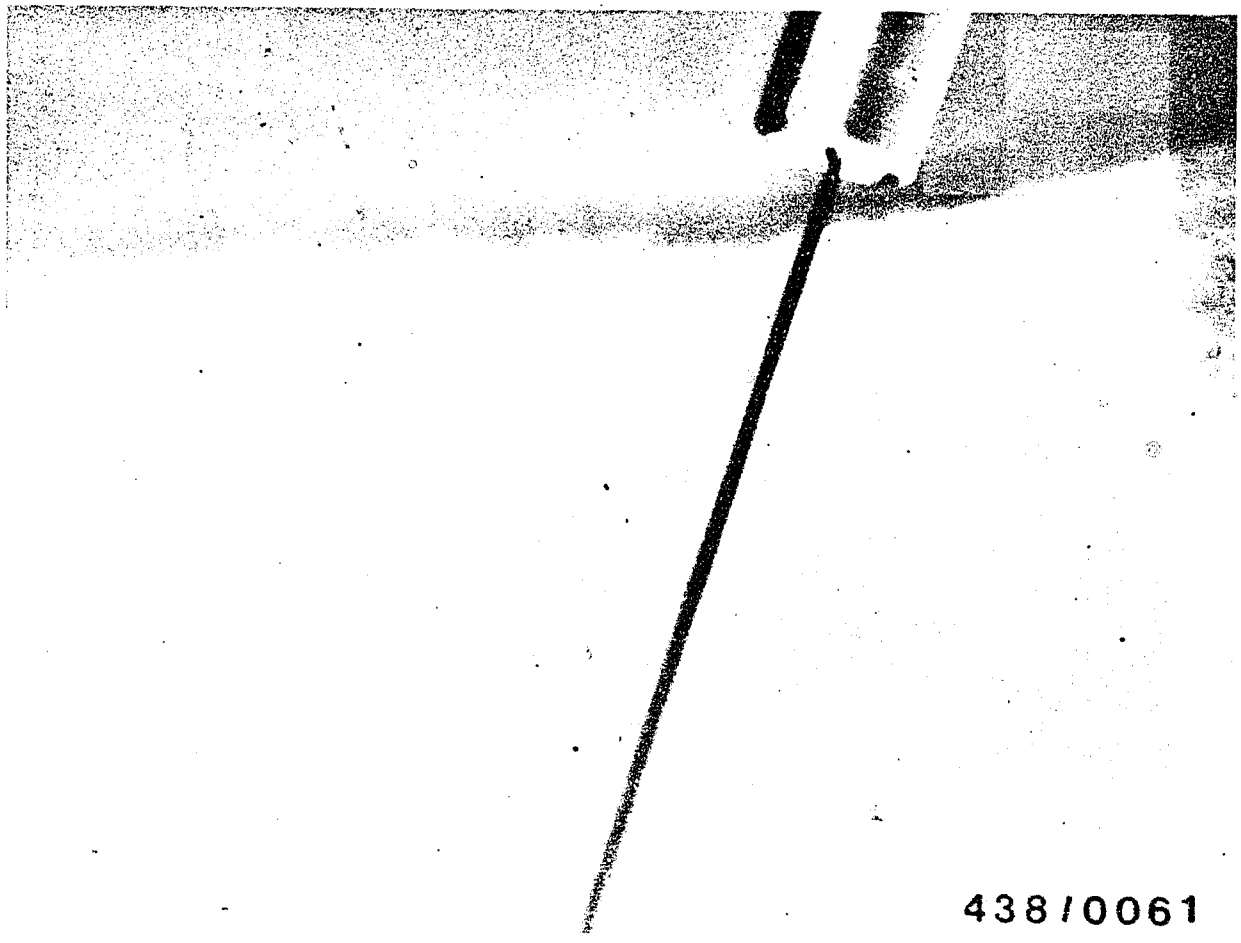
Illustration shows single-sided but nevertheless good spray formation.



438/0060

Poor spray formation; replace injection valves.

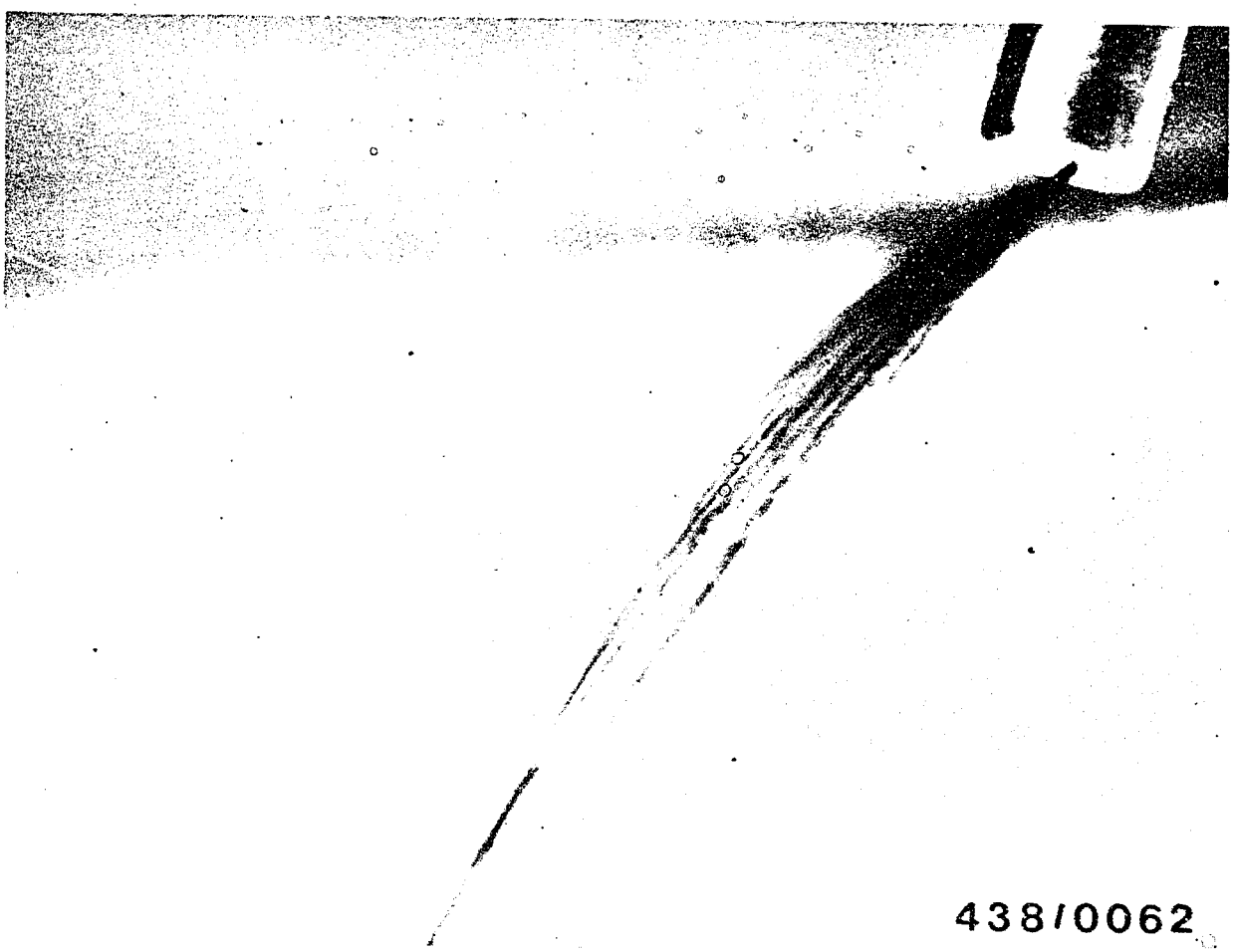
Illustration shows drop formation.



438/0061

Poor spray formation; replace injection valves.

Illustration shows "cord" spray.



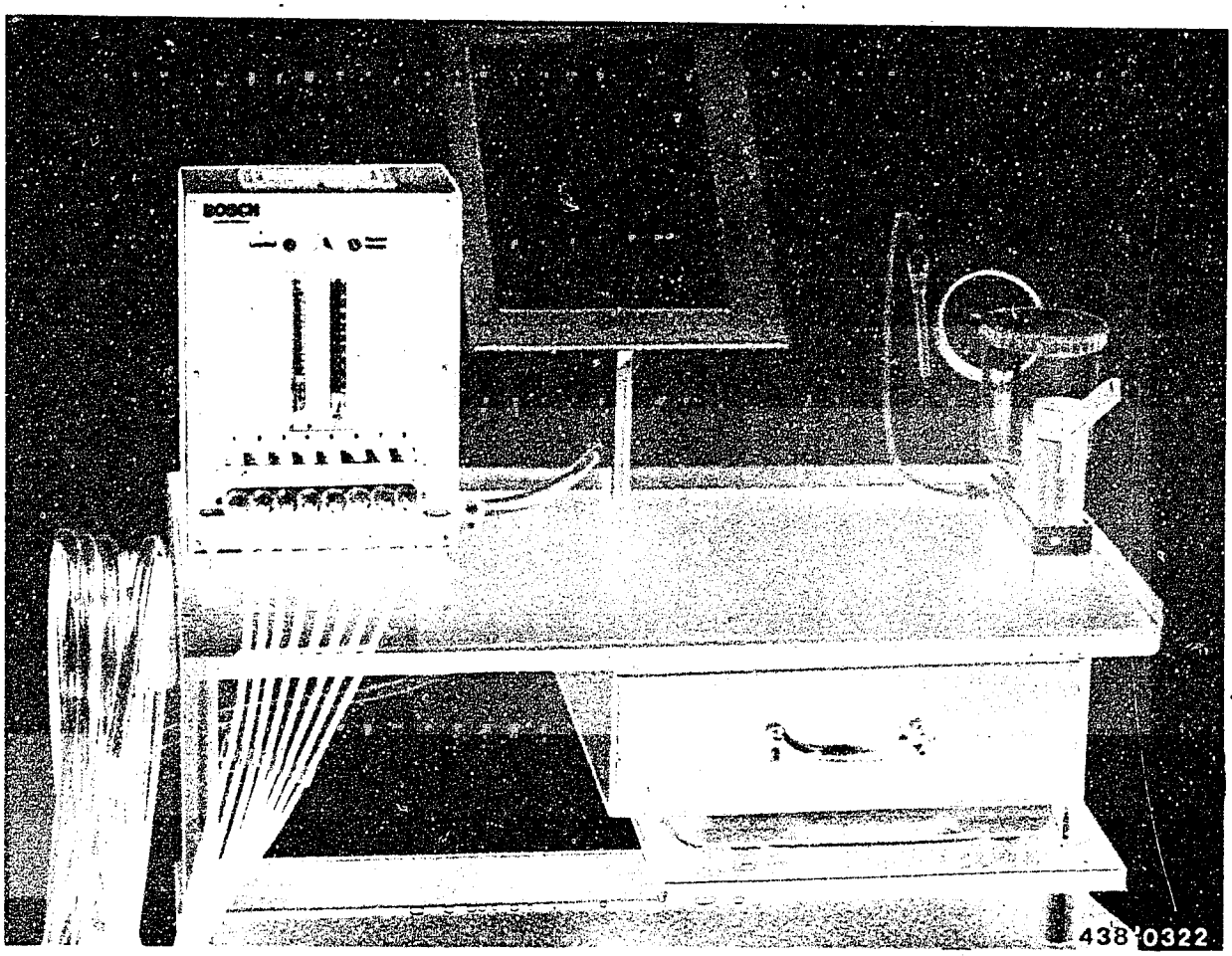
438/0062

Poor spray formation; replace injection valves.

Illustration shows "spray in strands".

If defective injection valves have been replaced, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.

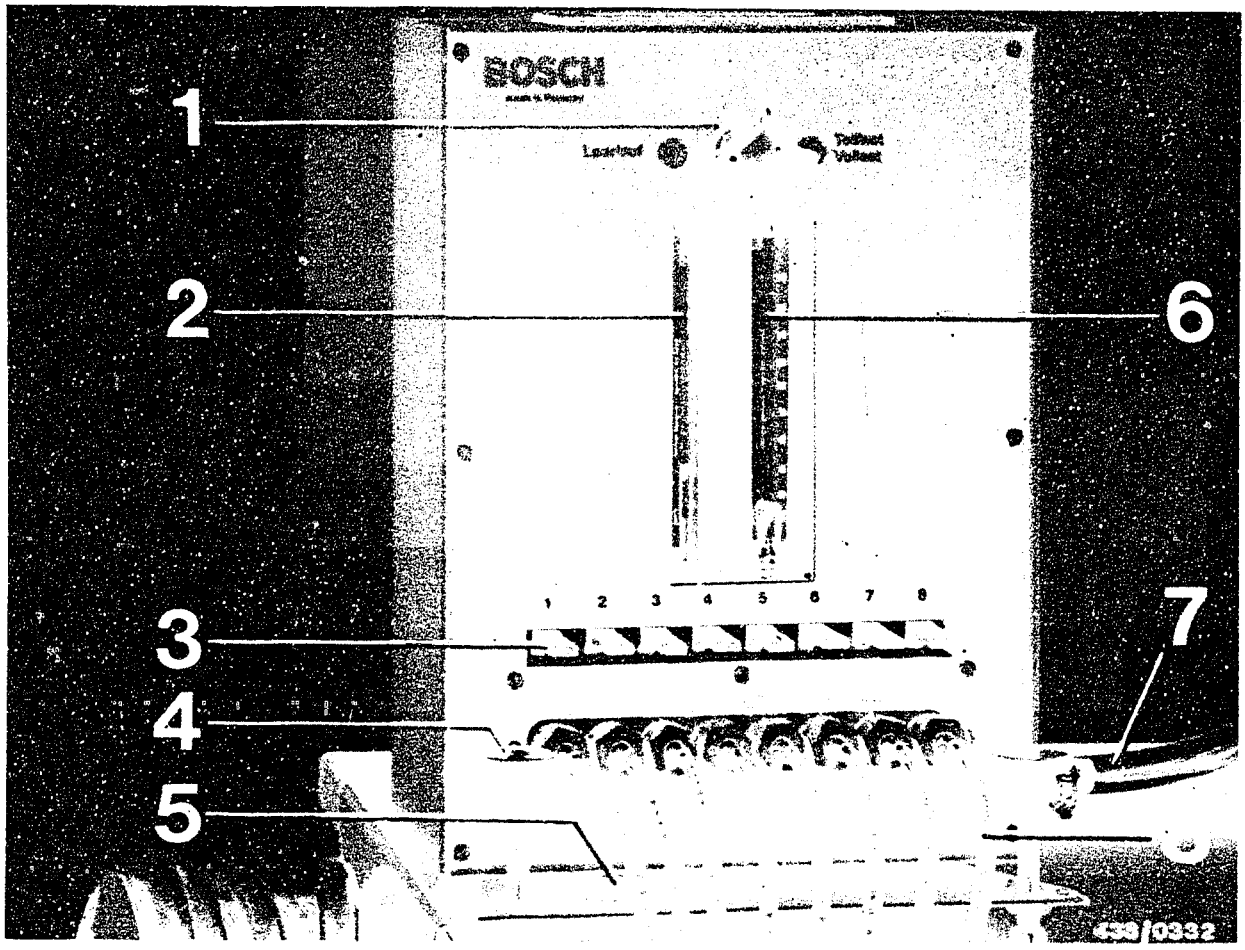
Idle-speed adjustment is described on Coordinates F 19.



18. Comparative measurement of fuel delivery of fuel distributor outlets.
This test is carried out using the tester for delivered quantity comparison KDJE-P 200 (previously KDJE 7451).

18.1 Application

By means of comparative measurements, the differences in the amounts of fuel delivered from the individual outlets on the fuel distributor are determined.
The tester is designed so that the test can be made on the vehicle without having to remove the fuel distributor.
Since the test is made with the original injection valves, the operator can recognize at the same time whether delivered-quantity scatter, if it occurs, is caused by the fuel distributor or by the injection valves.



1 = 3-way cock
2 = Small rotameter tube
3 = Keyboard for 8-way valve
4 = Adjusting screw for setting up
5 = Spirit level
6 = Large rotameter tube
7 = Return hose
8 = Polyamide hose lines (test lines)

18.2 Construction

The tester is designed for use with all engines, up to 8 cylinders, equipped with K-Jetronic.

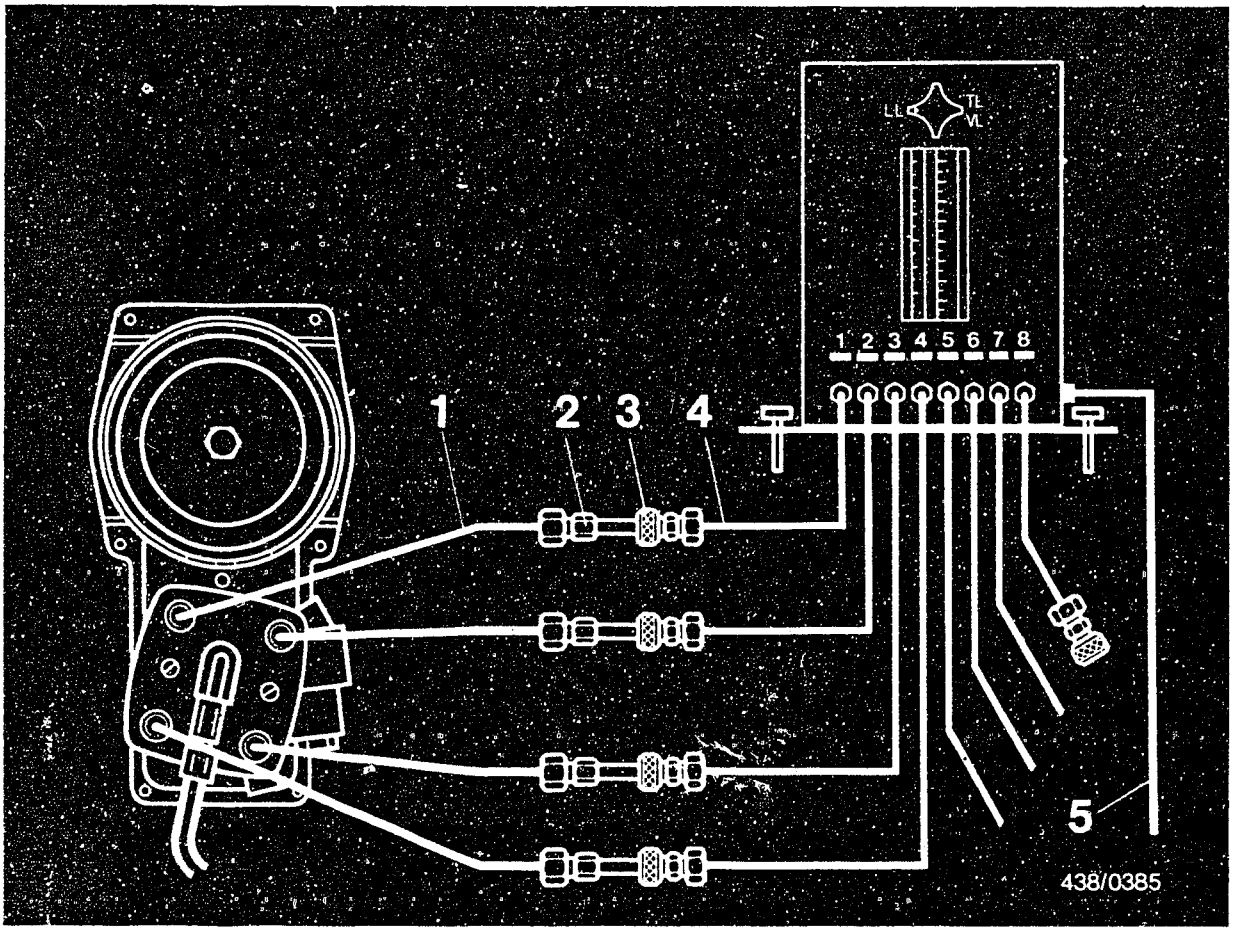
Basically, the tester consists of a steel housing containing 2 rotameter tubes with measuring ranges of 2...15 cm^3 and 10...180 cm^3, an 8-way valve for key operation (Item 3) and a 3-way stopcock (Item 1).

The small rotameter tube (Item 2) is used for the idle measurement while the large tube (Item 6) is used to measure the fuel delivery at part- and full-load. The particular rotameter tube to be used is connected by means of the 3-way stopcock. Using the 8-way valve, the fuel delivery of each cylinder is tested one after the other.

Attached to the tester are 8 hoses (Item 8), each terminated with an automatic connector. When the injection valves are withdrawn from their sockets on the engine they are attached to these connectors. Each automatic connector is fitted with a push valve so that no fuel can escape from connectors that are not in use (when 4- or 6-cylinder systems are tested).

The fuel is returned to the fuel tank through a hose (Item 7) about 5 m long.

The entire test is made with a closed circuit, i.e. no fuel escapes.



1 = Fuel distributor injection tubing
2 = Injection valves
3 = Automatic connectors
4 = Tester hoses
5 = Return line to fuel tank filler neck

18.3 Setting up and connecting the tester:

Set the tester up beside the engine on a solid base (e.g. on tester trolley KDJE-W 100) and align it with the built-in spirit level at the base of the tester.

Remove injection valves; the injection tubing remains connected.
Clean the injection valves with a rag and insert injection valves in correct sequence into the automatic connectors of the first four tester hoses.

Note:
Insert the injection valves as far as they will go and tighten the knurled thumbscrews well so that the non-return valves of the automatic connectors are open fully.
Introduce the return hose of the tester into the fuel tank filler neck.

18.4 Bleeding the tester:

Remove the rubber hood so that air-flow sensor plate becomes accessible.

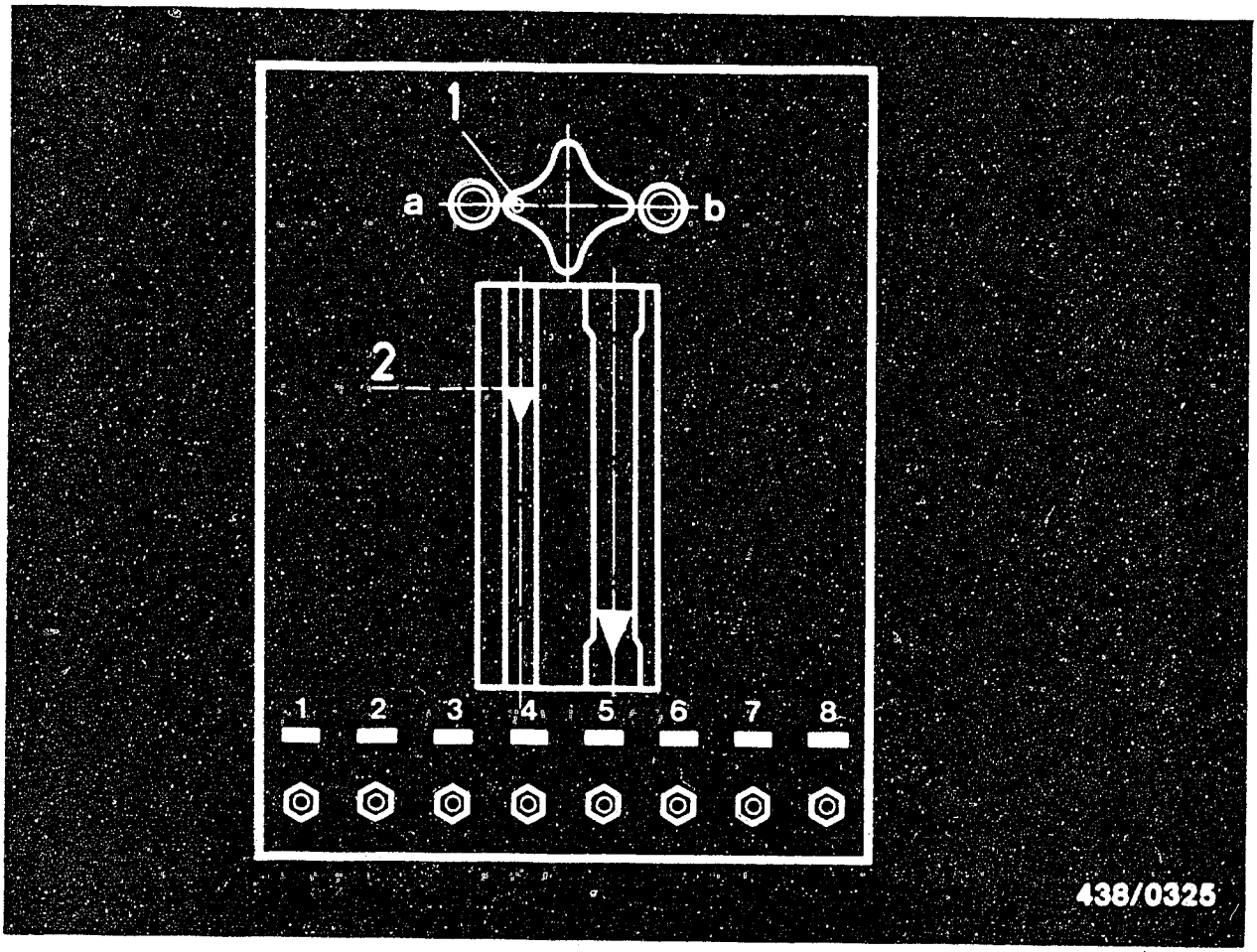
Remove the electric plugs from the warm-up regulator and the auxiliary-air device.

Switch on the electric fuel pump by bridging the electrical safety circuit.

Raise the air-flow sensor plate to the stop.

Press the keys on the 8-way valve one after the other, while simultaneously switching the 3-way stopcock until both rotameter tubes are bled.

Return the sensor plate to the rest position.

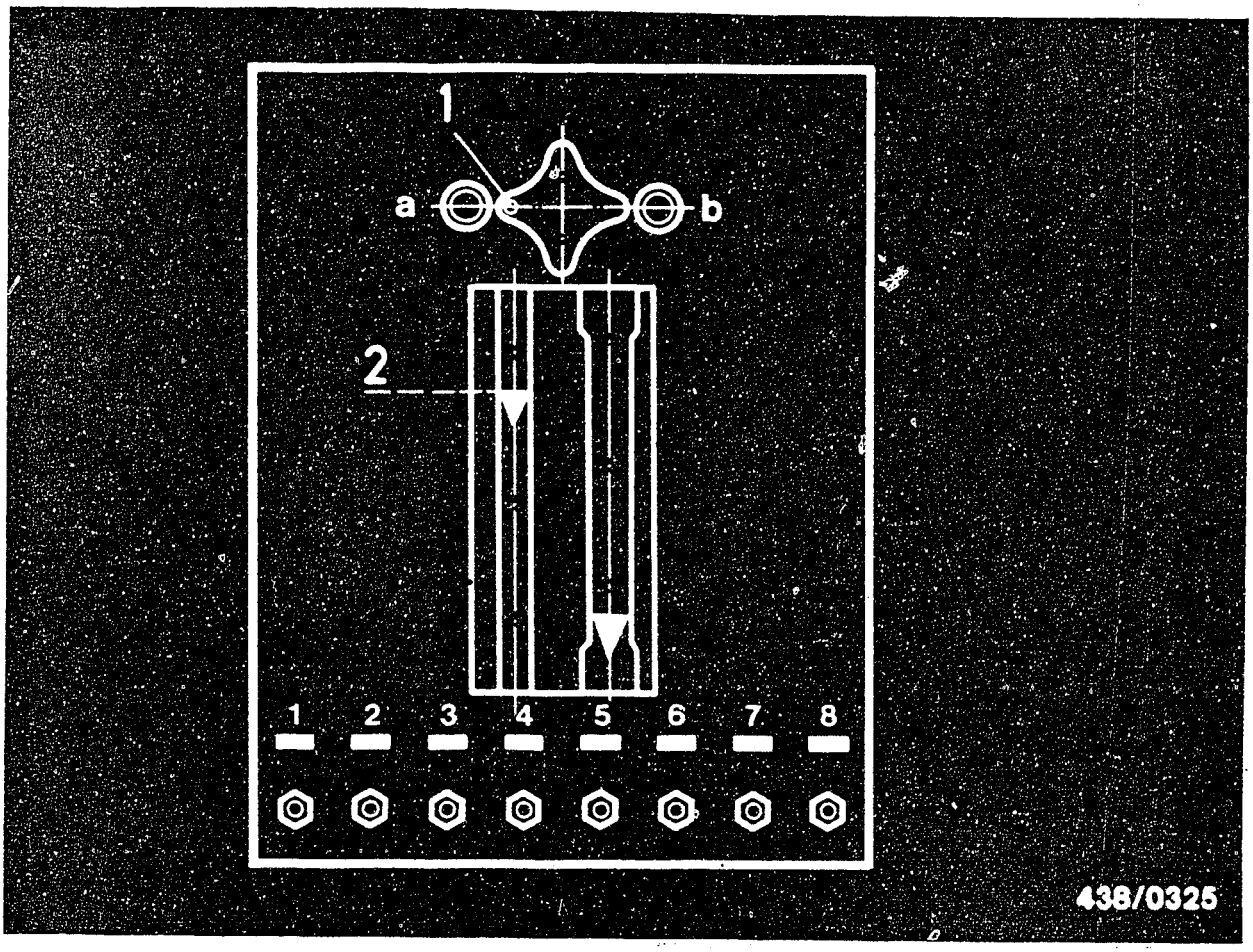


1 = White dot
2 = Measuring line

a = Idle
b = Part load/full load

18.5 Testing

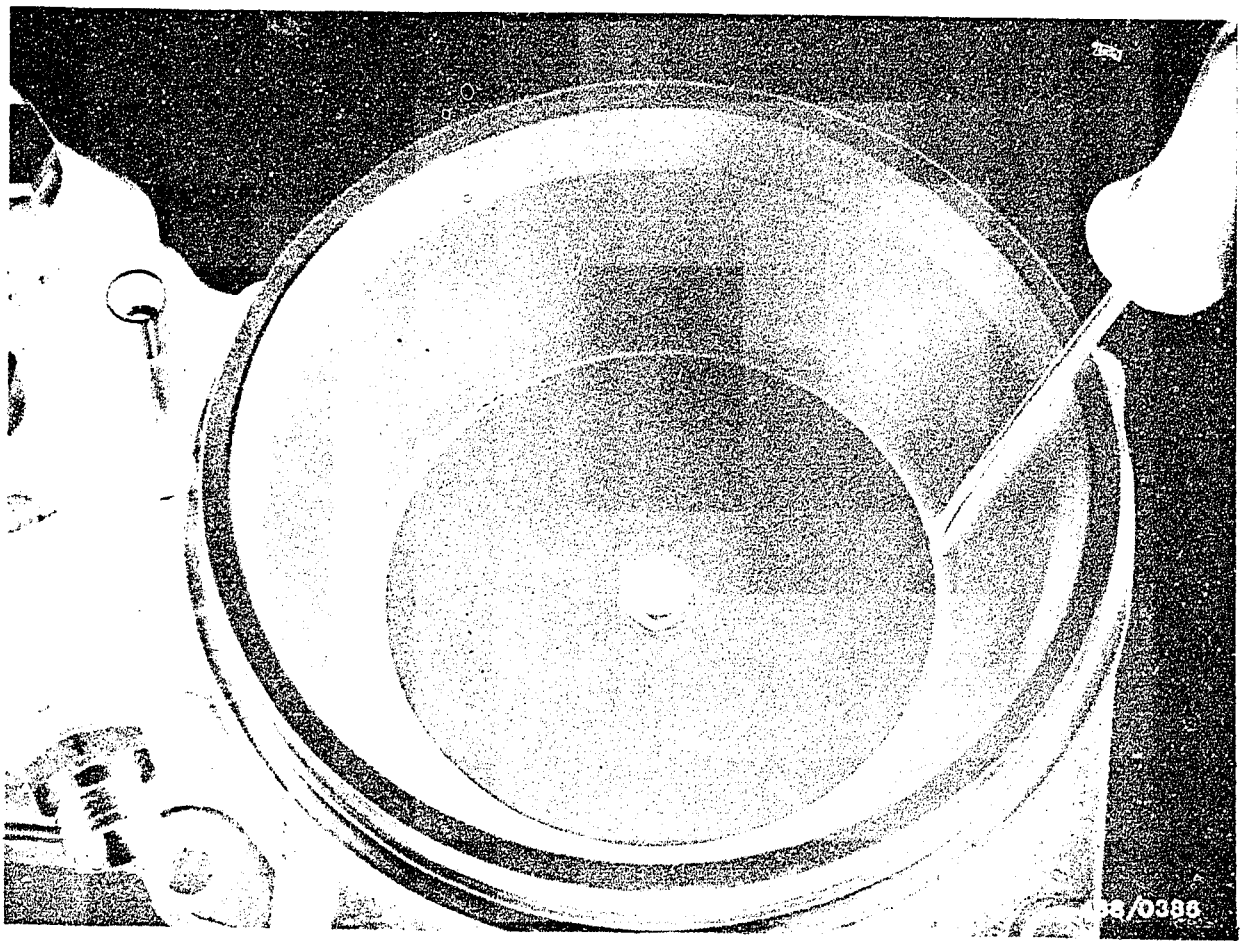
The flow comparison measurement is made in the idle, part-load and full-load ranges.
The small rotameter tube is to be used for the idle measurement (white dot to the left on control knob); part-load and full-load measurements are made using the large rotameter tube (white dot to the right).



1 = White dot
2 = Measuring line

a = Idle
b = Part load/full load

The delivered quantities indicated on the rotameter tubes are read off at the top edge of the conical float (Item 2). On testers with a ball float the uppermost point of the ball is used for reading off. With each measurement be sure to wait until the float has reached its final position. This may take 20 ... 30 seconds in the case of small deliveries.



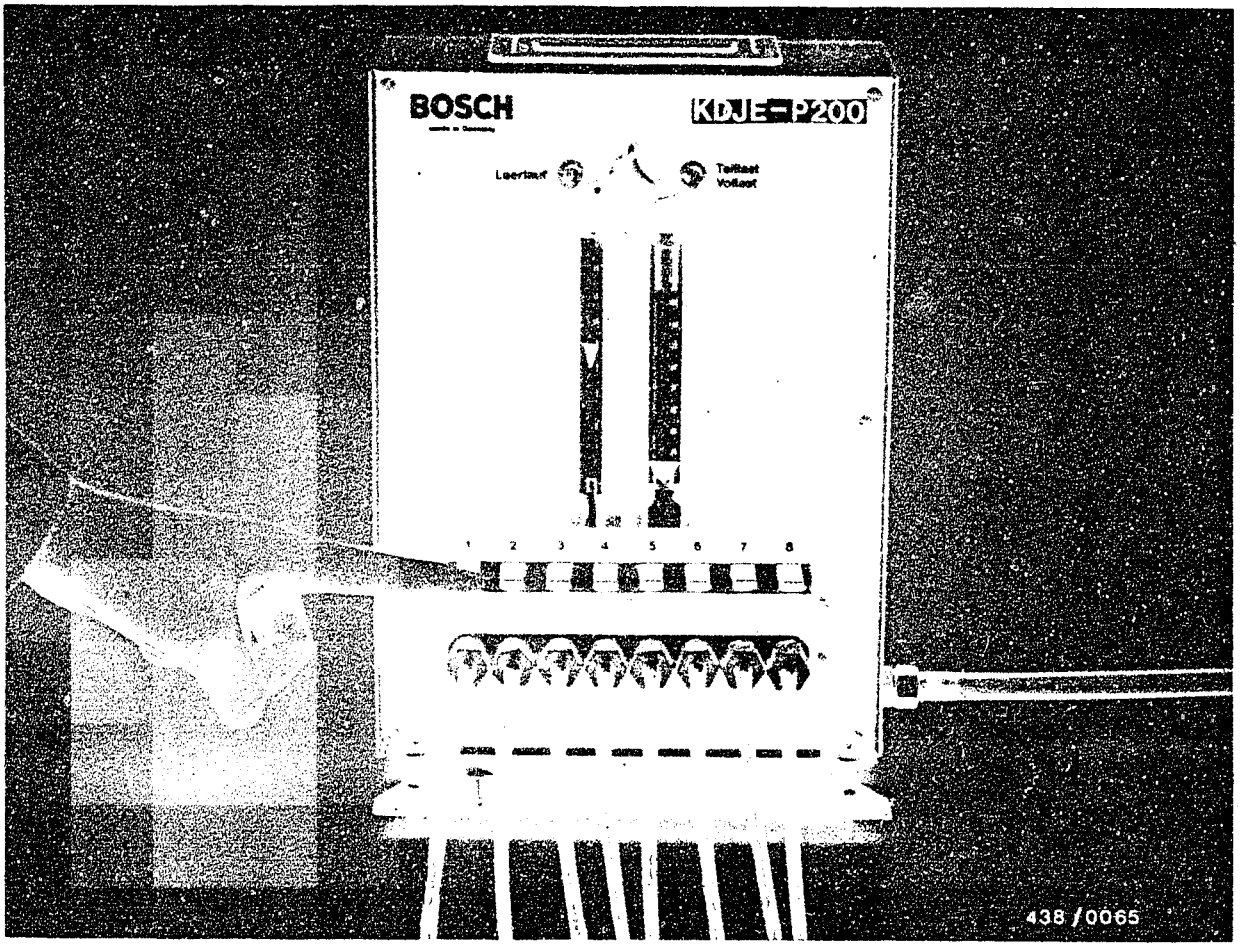
The exact setting and locating of the position of the air-flow sensor plate for the various load ranges is done using a screwdriver (a small one for the idle position), which is inserted to an appropriate depth between the air funnel and air-flow sensor plate.

Procedure:

Switch on the electric fuel pump by bridging the electrical safety circuit.

Fixed numerical values are specified in the following test section for the maximum permissible fuel delivery differences for the individual load ranges.

The "setpoint" value always pertains to the fuel-distributor outlet with the lowest fuel delivery, i.e. in each case the outlet with the lowest delivery is to be first ascertained.



Press the key for outlet 1. Pivot the air-flow sensor plate until the corresponding rotameter tube approximately indicates the "set point" value. Fix the air-flow sensor plate in this position.

Test the remaining outlets in order to determine which outlet has the lowest fuel delivery.

Press the key for this outlet again, and set the delivery precisely to the "set point" by correcting the position of the air-flow sensor plate. Then fix the air-flow sensor plate in this position again.

Press the remaining keys one after the other, and determine the maximum fuel delivery of each outlet. A deviation in fuel delivery can only be above the "set point".

18.6 Test specifications

	Setpoint (cm^3/min)	Max. permissible fuel delivery (cm^3/min)
Idle	6.0	6.8
Part load	40.0	44.0
Full load	160.0	175.0

If, in testing, a too large difference is ascertained in one of the three load ranges, the test should for safety's sake be repeated.

If the result is confirmed, you should check whether the fault lies in the fuel distributor or in the injection valves.

To do this interchange the injection valves with the greatest and smallest difference.

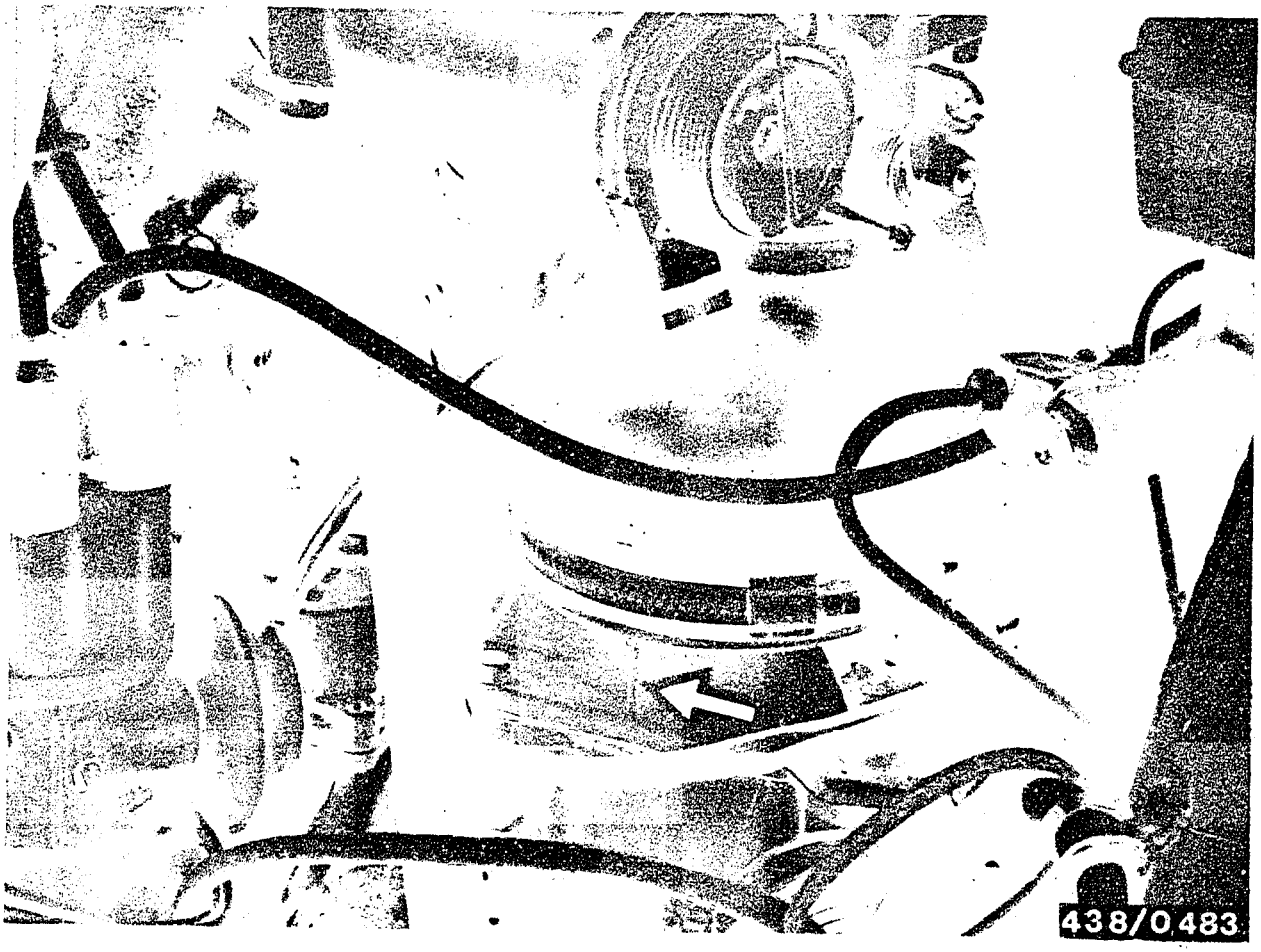
If the result is still the same, the fault is in the fuel distributor. If the fault follows the interchanged injection valves, it lies in the injection valves.

Change defective fuel distributor and/or replace defective injection valves.

18.7 Final operations:

Check the seal rings on the stem of the injection valves for damage and deformation. If necessary, use new seal rings (Volvo service part).

Install the injection valves and connect the injection lines.



Install the connection dome between air-flow sensor and throttle-valve assembly. Make sure that the arrow on the connection dome points to the reinforcing rib in the air-flow sensor housing (arrow).

Re-connect the electrical safety circuit of the K-Jetronic. Ensure this is done properly.

Finally, carry out the idle adjustment with the engine at normal operating temperature.
Idle adjustment is described on Coordinate F 19.

19. Idle adjustment

19.1 Test conditions, general for all models:

Warm the engine up for the idle adjustment (oil temperature approx. 80°C).

If the fuel-injection tubing or injection valves were loosened or removed, the engine should be warmed up under load. The low rate of fuel flow during idling is not always adequate to drive all the air out of the fuel-injection tubing.

The idle speed must not be adjusted when the engine is too hot, e.g. immediately after being raced or after a power measurement on the roller-type test stand.

In vehicles with an air conditioner, this should be switched off to stabilize the engine speed during idle-speed adjustment.

19.2 Test conditions for engine type B 23 E of the Sweden and Australia version:

This engine type is equipped with the following exhaust-gas purification systems: exhaust-gas recirculation and Puls-air system.

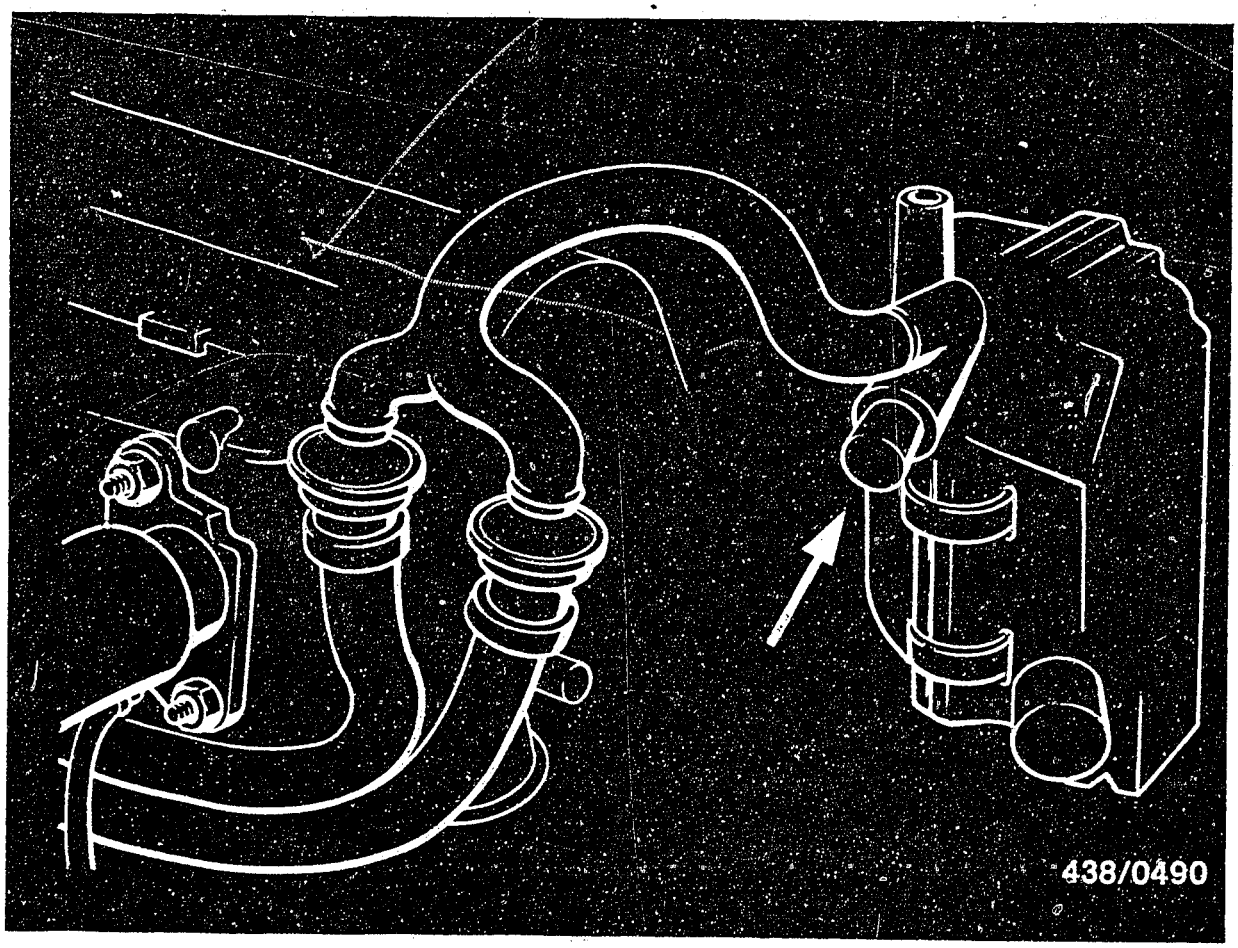
Before performing the idle adjustment, both systems must be rendered inoperative.

The following two coordinates describe how to do this.

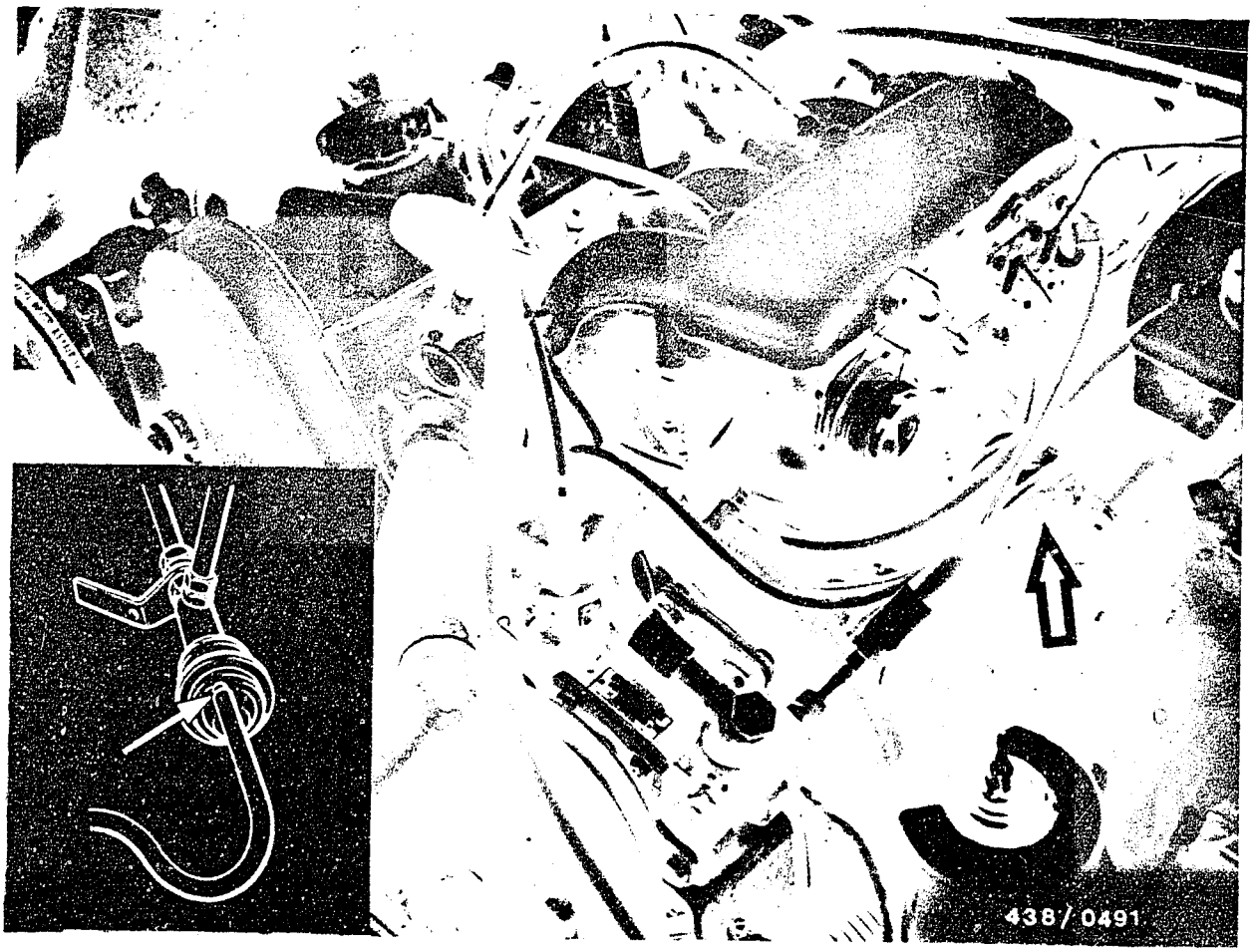
19.3 Puls-air system (only Sweden and Australia models with B 23 E engine):

With this system, unburned gases in the exhaust are after-burned by the injection of air, thus reducing the pollutants in the exhaust gas.

The system does not employ a secondary-air pump, but uses the pulsation in the alternation between overpressure and depression in the exhaust system.
When there is a depression, auxiliary air is drawn into the exhaust manifold. When there is overpressure, non-return valves prevent exhaust gas from flowing back to the air filter.



For checking/adjusting the idle speed, it is necessary to render the "Puls-air" system inoperative: to do this, remove the hose between the Puls-air valve and the air filter at the air filter (arrow) and seal off tight with a plug.



19.4 Exhaust-gas recirculation (only Sweden and Australia models with B 23 E engine):

With exhaust-gas recirculation, some of the exhaust gases are returned from the exhaust system to the intake system in order to take part once again in combustion. This reduces the proportion of nitrogen oxides in the exhaust gas. Exhaust-gas recirculation is controlled by an exhaust-gas recirculation valve as a function of intake-manifold pressure and engine temperature.

In order to adjust the idle speed, it is necessary to render the exhaust-gas recirculation system inoperative:

To do this, remove the vacuum hose from the exhaust-gas recirculation valve (arrows) and seal off tight with a plug.

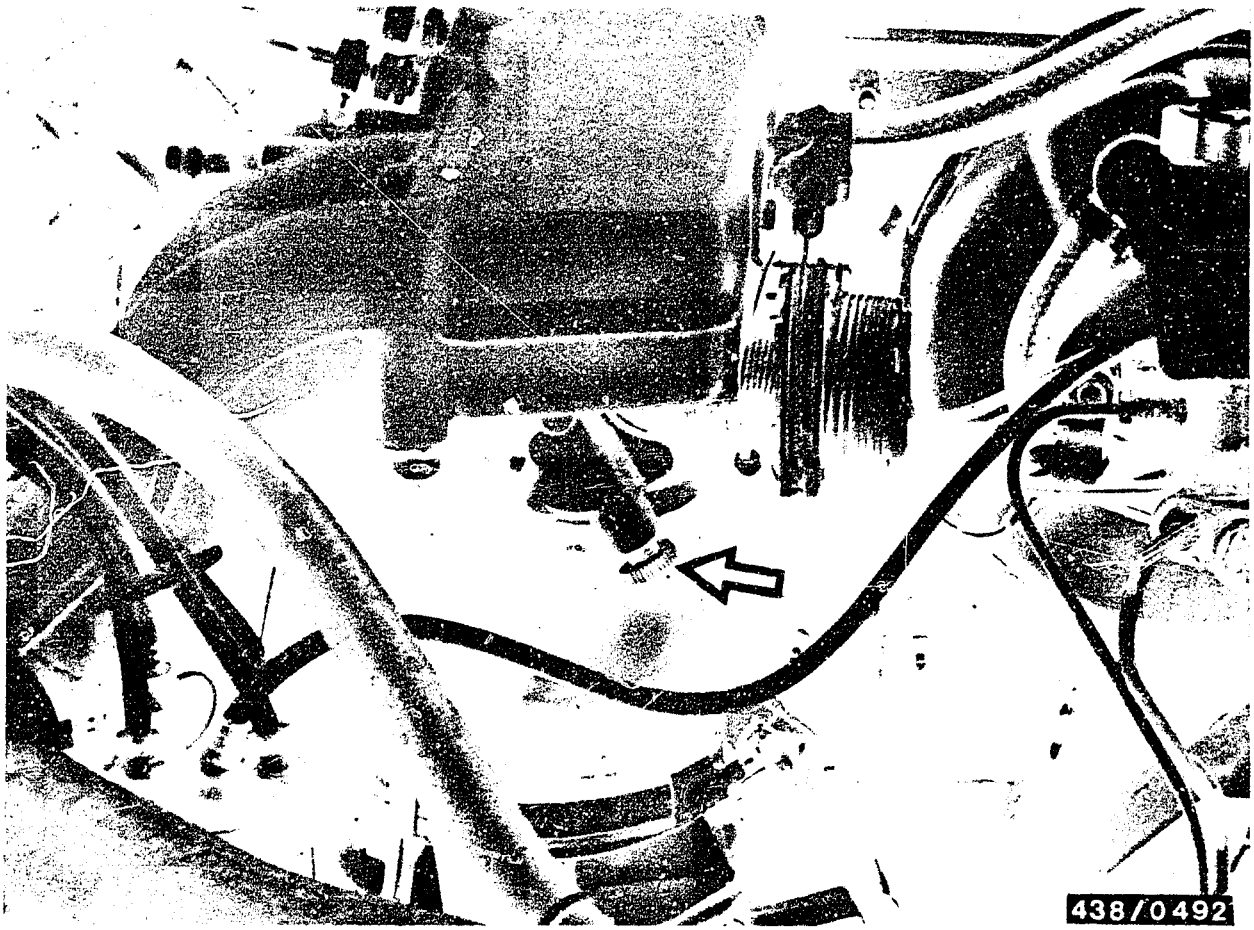
19.5 Test specifications for idle adjustment:

- Idle speed:
 All models — 900 min^{-1}

- CO concentration (% by vol.):*
 Checking value:
 B 19 E, B 21 E, 1978...1980 — 1.0...3.0 %
 B 23 E 1978...1980 — 1.5...2.5 %
 All 1981 models

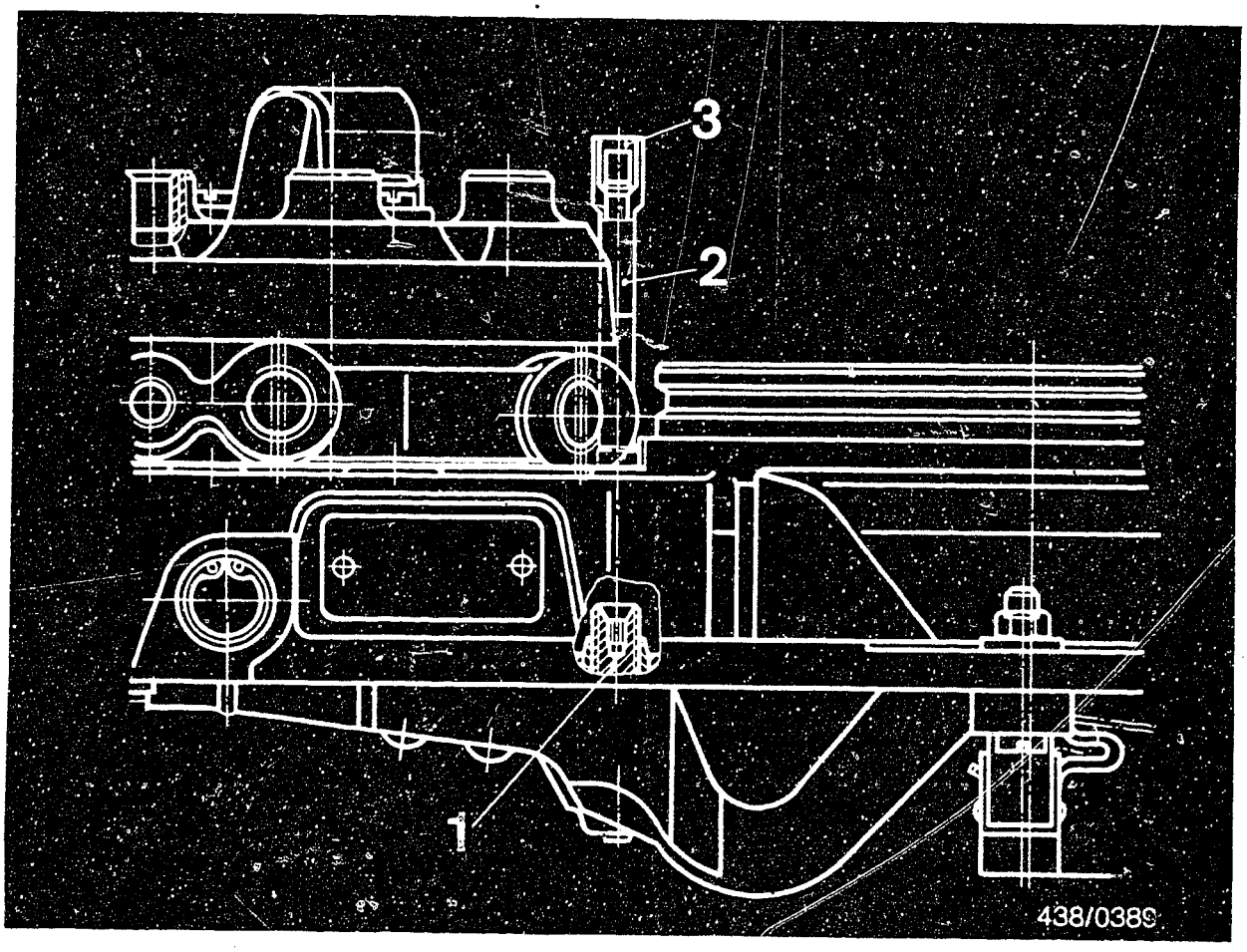
 Setting value:
 All 1978...1980 models — 2.0 %
 All 1981 models — 1.0 %

* CO re-adjustment corresponds to "setting value". Engines whose CO concentration is within the "checking value" tolerance need not be re-adjusted if otherwise idling smoothly.



19.6 Adjusting

Adjust the idle speed at the bypass screw on the throttle-valve assembly (arrow).



Adjusting the CO concentration

The CO concentration is adjusted by turning the idle-mixture-adjusting screw (1) in the mixture-control unit using the adjusting wrench KDEP 1035.

After removing the safety cap (3) of the guide tube (2), the adjusting wrench is passed through the guide tube and inserted into the idle-mixture-adjusting screw.

Turning to the right = richer mixture
Turning to the left = leaner mixture

Caution:
Always make the adjustment from the lean side, i.e. if the mixture is too rich turn the idle-mixture-adjusting screw further to the left than necessary and then turn it to the right up to the setting required.

After every adjustment remove the adjusting wrench and accelerate the engine briefly, so that the air-intake system can cool off. Then wait until the indicator of the CO tester has stabilized. Never accelerate the engine with the wrench still in place as this could result in bending the control lever in the air-flow sensor.

19.7 Anti-tamper device for idle-mixture-adjusting screw:

In the Federal Republic of Germany, § 47 of the FMVSS/CUR, "Exhaust Gases and their Discharge", has been amended. This amendment order was printed in full in the Verkehrsblatt 13 of 15th July 1975.

Accordingly, all motor vehicles with externally supplied ignition produced as of 1 October 1976 must be provided with anti-tamper devices for the idle-mixture-adjusting screw so that it is not possible to adjust the screw without destroying the anti-tamper device. The intention is to prevent non-experts from re-adjusting the idle setting and thus inadmissibly influencing the exhaust gas. Consequently, the anti-tamper caps may only be used in the workshop and must not be sold to customers for their own use.

These anti-tamper caps come in different colors. The cap to be used for the after-sales service is red. It can be obtained from Bosch under part number

3 430 522 002.

The anti-tamper device for the air-flow sensor is removed and fitted using special tools (e.g. No. 4521/7 from the firm Hazet, D-5630 Remscheid).

After-sales Service

Technical Bulletin

Only for use within the Bosch organization. Not to be communicated to any third party.

43

Continuous Injection System mixture control-unit

VDT-I-438/100 B

Ed. 2 7.1975
Translation of German edition of 1.7.1975

The mixture control unit is still being reported as one defective unit in warranty claims. We wish to point out expressly that the mixture control unit consists of two separate products, the air-flow sensor and the fuel distributor, and that there are separate defect numbers for them in the warranty manual. Please report only the defective product.

Accessory Sets

Various fuel distributors and warm-up regulators have been supplied up to now with pressed-in plug connectors. These will no longer be supplied in future.

	no longer available	Replacement + accessory set
Fuel distributor	0 438 100 002	0 438 100 017
	0 438 100 003	0 438 100 005 + 2 437 001 001
	0 438 100 004	0 438 100 017
Warm-up regulator	0 438 140 002	0 438 140 004 + 1 437 000 000

The accessory sets contain the required number of tailpieces and seal rings.

Please note: the accessory set 2 437 001 000 is delivered included with the fuel distributor 0 438 100 017, and does not therefore need to be ordered separately.

Electric Fuel Pump

In the Technische Mitteilung VDT-BMO 114/1 B and the Service Information sheet VDT-I-740/2-1 B 1st. supplement, we announced that the non-return valve can be replaced on the electric fuel pump 0 580 254 996. We have come to the conclusion from the warranty claims that not enough use is being made of this possibility. Please bear this fact in mind and repair leaky electric fuel pumps before deciding to replace the entire assembly.

In case of inquiry, please contact your authorized representative.

ROBERT BOSCH GMBH
Geschäftsbereich KH
Kundendienst - Technik

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SUPPLY PUMPS 0 580 ..

Overview of the non-return valves

438
VDT-I-438/104 En
9.1979

Replaceable non-return valves

Part Number	Appropriate seal ring	Fitted in supply pumps
1 583 385 004	1 580 203 002	0 580 254 990, ..991,..998
.. 006	.. 002	.. 985
1 583 386 008	.. 001	.. 987, ..988,..989
.. 011	.. 001	.. 986, ..996
.. 014	.. 001	.. 992
.. 016	1 580 105 001	.. 970, ..971,..972,
		.. 973, ..974,..980

Parts sets (comprising non-return valve complete with seal ring)

1 587 010 001	-	0 580 254 992
1 587 410 901	-	.. 978, ..982 FD823→

Supply pumps fitted with non-replaceable non-return valves

0 580 254 975, ..976, ..977, ..979 and ..982 → FD 822

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Packaging of goods under warranty

438

K-Jetronic (CIS)

VDT-I-438/101 B
10.1976

All components or assemblies of the K-Jetronic which are dispatched under warranty must be correctly and carefully packaged so that no further damage or impairments occur during transit, since these would not be covered by warranty.

Any fuel remnants must be removed from those K-Jetronic assemblies intended for dispatch, so as to eliminate any danger of fire during transit.

The intake openings and outlets of the assemblies must be sealed off with caps or plugs. As new products were fitted, the caps or plugs from these may be used.

The plunger of the fuel distributor is to be fitted with a protective cap of adequate size, or secured to the fuel distributor.

In addition, the assemblies are packed in tightly packed, well-sealed plastic sleeves. Fuel distributors and warm-up regulators are packed individually.

If components arrive damaged due to incorrect packaging or do not comply with these instructions, they can be returned and the warranty claim rejected.

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HOT-STARTING PROBLEMS

438

VDT-I-438/105 En
3.1980
Replaces Ed. 2.1980

K-Jetronic

Hot-starting problems can occur in various vehicles fitted with K-Jetronic. This means that when an engine is switched off whilst still hot and then switched on again after a short period, it does not start as well as it should.

The engine, the ignition system and the K-Jetronic system in these vehicles should be carefully checked. With the K-Jetronic particular attention should be paid to the:

complete system (in case of leaks),
injection valves (in case of leaks),
correct position of the air-flow sensor plate (rest position).

Instructions can be found in the vehicle-related repair manuals VDT-W-438/5.. .

If the engine still does not start satisfactorily when hot, even after checking, a timing relay can be fitted in K-Jetronic systems which are not equipped with a solenoid valve for reducing the control pressure as additional starting help.

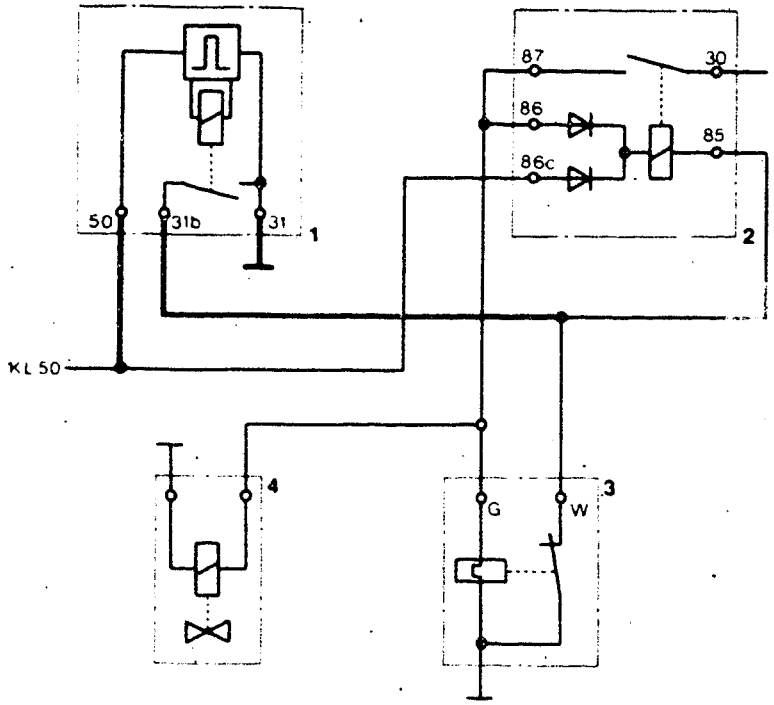
Timing relay 0 340 000 003 controls the start valve during hot starts. The start valve then injects extra fuel intermittently (sometimes cutting out completely.

The timing valve is fitted according to the wiring diagram (see reverse side). The fitting of this relay will be charged for.

After fitting the timing relay starting should be carried out as follows:

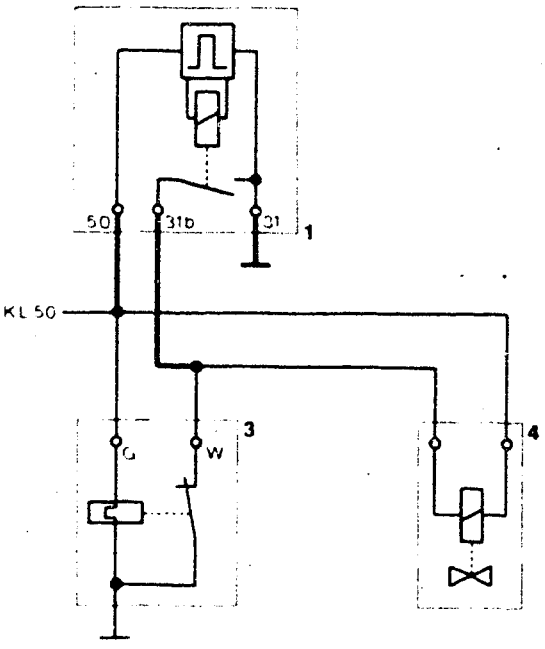
Vehicles with start valve in intake manifold - with open throttle valve,
Vehicles with start valve in idle duct - with closed throttle valve.

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K-Jetronic system with post-injection relay

1 = Timing relay 0 340 000 003
2 = Post-injection relay
3 = Thermo-time switch
4 = Start valve



K-Jetronic system without post-injection relay

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